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TRICHOMONAS AS A PARASITE OF MAN.*

By George Dock, A.M., M.D.,
PROFESSOR OF MEDICINE IN THE UNIVERSITY OF MICHIGAN, ANN ARBOR, MICH.

In 1836 Donné[1] found a previously undescribed parasite in the vaginal secretions of women. These were described as roundish bodies about twice the size of pus corpuscles and difficult to distinguish from the latter except by their independent motion. The motion was produced by certain organs, viz., a flagelliform appendage at the anterior end which worked with great rapidity, and a row of short cilia, at one side and near the flagellum, which kept up a sort of rotary motion. At the posterior end was a tail-like appendage of variable shape (Fig. 18). On account of the fact that the parasite resembled monads in having a flagellum, and "trichodines" (ciliata) in having cilia, Donné gave it the name of trichomonas, with the specific name *vaginale* on account of the habitat. Although there were errors in Donné's description, it was remarkably good considering the methods of observation and the knowledge of micro-parasites then available. Certain details in the description will be mentioned later. Notwithstanding Donné's growing reputation as a microscopist, and the fact that his observations were controlled by such men as Dujardin, Milne-Edwards, Ricord, and others,[1] many microscopists (Vogel, Siebold, Valentin) denied the parasitic nature of the bodies, and held them to be altered epithelial cells from the uterus. Later, however, Scanzoni and Kölliker,[2] Hennig,[3] Haussmann,[4] and Gasser[5] re-examined the organisms, mostly from the side of clinical microscopy. Still later Künstler[6] and Henneguy, in France,[7] and Blochman,[8] working under Bütschli, in Germany,[9] made

* Read before the Pathological Society of Philadelphia, April 25, 1895.

investigations in the biology of the organisms, which, while differing in many respects, have added considerably to our knowledge. Within the last year Marchand[10] has examined the parasites with results to be mentioned later.

On the whole, the parasites have been deemed of so little importance that scant notice is given them. The descriptions in most text-books on gynecology, microscopy, and pathology are inadequate or erroneous, and the same is true even of some recent works on animal parasites.

An extensive but necessarily incomplete search of the American literature fails to reveal any reference to the occurrence of trichomonas vaginalis in this country. I have found it once only in the vaginal secretions of a pregnant woman in Galveston, Texas. Since my interest in the matter has been excited I have looked for it, but without success. This may be explained partly by the small number of persons examined, partly by the cleanliness of the subjects and the almost universal use of douches—the organisms being very sensitive to cold water.

Since the discovery of Donné, zoölogists have found parasites of the same kind, or closely related, in snails, frogs, ducks, etc.[11, 12, 13, 14] With the exception of Stein, however, none of these writers have influenced the study of the human parasite.

Flagellate organisms have been observed in stools since an early period. In many cases the organisms belonged to the kind first described by Davaine,[15] who found them in cholera and typhoid fever, and named by him cercomonas hominis. The efforts of some writers to deny the existence of these bodies, or to identify them with trichomonas, have not met with entire success. I[16] have encountered this same parasite in amœbic dysentery and typhoid fever and agree with Leuckart when he says that Davaine's observation, though one of the oldest, is still one of the best and most accurate. The same organisms have been found by Ekecrantz,[17] Tham,[18] Cunningham,[19] Grassi,[20] von Jaksch,[21] Müller,[22] Massiutin,[23] Kartulis,[24] Cahen,[25] Lutz,[26] Councilman and Lafleur,[27] Schuberg,[28] and others.* This parasite has to be considered at many points in studying trichomonas, as we shall see. We must leave it now to take up the history of some intestinal flagellates more closely related to the latter.

In 1875 Marchand[31] found large numbers of infusoria in the evacuations of a case of typhoid fever. He thought they might have been the same as those of Davaine and Lambl, but they had cilia, which the earlier observers did not mention, but had no flagellum as had Davaine's organism. The flagellum, however, Marchand thought might be extremely hard to see.

* The parasites found by Lambl[29] in the stools of children, and often spoken of as cercomonads, were really of a different genus, Megastoma or Lamblia. (Cf. Braun, 49, p. 111.) Lambl's cercomonas from the liver[30] cannot be definitely placed; at all events it does not require further consideration now.

Soon after Zunker,[32] in the course of systematic examinations of stools, found parasites like those of Davaine in two cases and in seven others another form, which he thought similar to that found by Marchand. The description and the figures in this report differ from those of Marchand, and yet any one familiar with such organisms will admit that it is possible both Marchand and Zunker found the same organism. Based on these two reports, the accuracy of which he doubted in some particulars, Leuckart erected the species trichomonas intestinalis, which has since been accepted by some others.[33]

Grassi (*loc. cit.*) found parasites which he considered identical with cercomonas Davaine and trichomonas intestinalis Leuckart, and placed these together in a genus named by him monocercomonas. It is almost certain that some of Grassi's organisms belong to trichomonas intestinalis Leuckart, and differ considerably from cercomonas.

Under the novel name of cercomonas coli hominis May[34] described an organism discovered in the stools of a patient with carcinoma of the stomach and chronic intestinal catarrh. This, also, from the description and figures (see Figure 23 of this article) appears to be a trichomonas, and Schuberg is, no doubt, right in saying that it is one. Why he gave it the new name May does not say.

Roos[35] found flagellate parasites in the stools in a number of cases, and supposed they represented a number of distinct varieties, some being like those of Davaine, others like those of Marchand, others still like those of Zunker, and, again, after reading May's article, like the bodies described by that observer. This seems to have been caused by an indistinct knowledge of what the earlier observers had described. Some of Roos's figures represent typical trichomonads; his Figure 5, for example, is almost precisely like Miura's Figure 2 of the trichomonas found in the urethra, yet Roos calls this cercomonas Davaine. Altogether, the *naïveté* of the account is remarkable.

Epstein[36] has made extensive observations on flagellate protozoa found in the stools in twenty-six cases of infantile diarrhœa. Although Professor Hatschek determined these to belong to the genus monocercomonas Grassi, the full description and the figures in Epstein's excellent paper show certain differences as compared with those of Grassi. As the parasites seem common in Prague, we can, no doubt, expect further valuable results from their study in future. Some important clinical and pathological data of Epstein's will be mentioned later.

This short summary includes all the material available regarding flagella in the human intestines or their excretions. Diverse and often contradictory as the original documents often are, a careful study of them makes it certain that some species of trichomonas, or, in other words, some organisms closely related to the parasites so named by

Donné, are parasites at times in the human intestine. A consideration of the possible effects of the organisms must be postponed.

Organisms identical with some of those just mentioned (cercomonas mostly) have been found in the mouth (Steinberg, quoted by Leuckart, *loc. cit.*, p. 304); in abscess of the tonsil (Lenhartz[37]); in the nose (*ibid.*); in gangrene of the lung and in pleurisy (Kannenberg,[38, 39] Streng,[40] Litten,[41] Lenhartz, *loc. cit.*; and Roos, *loc. cit.*). Important in connection with the subject of flagellate parasitism, these reports are not of a kind to detain us longer at this time.

Observations on flagellates in the urine or bladder are few, but of great interest, and permit a critical examination much more readily than those relating to the intestines.

The first observation on flagellates in the urine is usually said to be that of A. Hill Hassall.[42]* An examination of Hassall's paper, however, makes it clear that his observations do not belong here at all. Hassall described the organisms he found under the name of *Bodo* Ehrenberg. The members of this genus have certain resemblances to trichomonas, but there are weighty reasons for believing that Hassall did not confuse the genera. In the first place he was familiar with Donné's figure, having copied it in his well-known work on microscopic anatomy (Vol. i, p. 134; Vol. ii, Plate xii., Fig. 6).[43] In the latter article he does not speak of trichomonas, as he would have been likely to do had he thought, as later authors have done, that he had found that parasite in the urine. More important still is his testimony regarding the vital characteristics of the so-called bodo urinarius. Hassall said this was "generated in urine which is alkaline, contains much animal matter, and which is, moreover, freely exposed to the air." The organisms appeared under the above conditions in three or four days, by which time trichomonads would have disappeared had they been present in the beginning. It is most probable that Hassall saw some infusorial monads, of no present importance whatever, and having no relation to human pathology.

In 1868, Salisbury[44] stated that "trichimonas *vaginæ* [*sic*—this form was used by some of the early writers] occurs occasionally in the bladder." Exact details are wanting.

Künstler, of Bordeaux, in 1883,[45] reported the first case in which flagellates were found in freshly passed urine. The case was one of pyelitis following cystotomy. In the copious sediment were bodies which Künstler thought might be cercomonads or the bodo urinarius of Hassall, although he remarked that they did not agree with Hassall's description. The bodies, he said, had two flagella, although at times it seemed as if three or four might be present. Künstler laid stress on the

* This refers to human urine. From the time of Leeuwenhoek flagellates have been described, usually very vaguely, in the urine of lower animals.

fact that the parasites came from the interior of the patient's body, where they lived in company with various bacteria. From the classification of Braun[9] (p. 108), it appears that Künstler at a later date assigned the parasites to the genus Plagiomonas Grassi. I cannot find a reference, and from the original description can see no reason for such a classification. Braun's statement that Blanchard called Künstler's parasite cystomonas urinarius I am also unable to verify. It remains doubtful whether Künstler's parasites were really trichomonads.

Dr. F. Tilden Brown presented specimens and photographs of "ciliated infusoria in the urine" before the section of Genito-Urinary Surgery of the New York Academy of Medicine, December 12, 1893.[46] Dr. Brown has not yet reported the case in full, but from letters he was kind enough to write me, it appears that the organisms belong to the ciliata, and therefore do not come under consideration here. The observation is extremely interesting, inasmuch as it widens the horizon of the protozoan parasites of man.

The first undoubted case of trichomonas in the urinary tract of man is that of Marchand.[10]

The host was a man, aged sixty years, who had a fistula in the perineum. The fistula followed suppuration in the pelvis, of seventeen years' duration, thought to be tuberculous. Pus appeared suddenly in the urine without symptoms of cystitis, so that rupture into the bladder was suspected. The general condition improved, but the urine remained turbid and was sent to Marchand for examination. It was acid and albuminous, with a copious, dirty-yellow sediment. In the sediment were numerous whitish particles, made up of epithelial cells of different kinds, hyaline casts, and red blood-corpuscles. Among the epithelial cells were curious hyaline bodies, larger than leucocytes, which proved on closer examination to be flagellates. The urine was examined daily for some time, but the occurrence and condition of the parasites was variable, so that it was with great difficulty that their nature could be made out. The fresh urine always contained numerous bacilli and cocci. Tubercle bacilli could not be found. The flagellates were almost exclusively in loose epithelial cell masses.

Marchand's description and figures leave no doubt that the parasites he found in this case are identical with those I found and reported later. As the result of comparative examinations of the parasites from the bladder and those in the vagina, Marchand concluded that there is at least a great resemblance if not identity. The former he found more hyaline, less plainly vacuolated, smaller, and more amœboid than trichomonas vaginalis. He doubted, with a caution unusual in the history of the intestinal flagellates, whether these differences suffice to prove different species, and thought they depended on the different media in which the organisms live. In a note to Miura's article, Professor Marchand says he thinks it probable the parasites lived in the urethra.

From the history given it seeems more probable there had been a rupture into the bladder, as supposed at first.

By a curious coincidence, a short time after publishing his own account, Professor Marchand received from Dr. K. Miura, of Tokio, the account in manuscript of another case in which trichomonads were found in the urine of a man.[47]

The patient was a Japanese, aged fifty-two years, with bronchitis and slight tenderness in the left renal region. The freshly passed urine, of yellow color and acid reaction, contained several thread-like particles and small bits. These were composed of round cells, colorless mucus, different kinds of epithelial cells, and flagellates. Miura examined the bodies with inadequate instruments, and his description of them is imperfect for that reason. He did not see all the flagella, although he was certain about the undulating membrane. He gave, however, other evidence as to the identity of the parasites. He found that most of the particles were passed with the first part of the urine, and by putting in a self-retaining catheter convinced himself that the organisms came from the urethra and not the bladder. The source of infection thus made probable was confirmed by examining the patient's wife, and finding in the vagina flagellate organisms resembling in form and size those in the urine of the man.

The next case, and only other, so far as I can learn, was one observed by myself and reported briefly in a preliminary note.[48]

The history is as follows: A. B., aged twenty-seven years, student. Father living and well. Mother died in childbirth. Patient was born in Illinois and lived there eleven years. Then lived near Gainesville, Texas, for thirteen years; in Oklahoma one year and a half; and in Bryan, Texas, one year. Since then has lived in Ann Arbor, with the exception of two months in Florida. As a child had measles, whooping cough, and scarlatina, without sequelæ.

For about nine years, while living in Texas, had malarial fever, usually of tertian type, sometimes quotidian. About 1884 had a "congestive chill" and was unconscious several days. Ever since then has had frequent urination. In the spring of 1892, while living at Bryan, Texas, had pneumonia. During convalescence painful and difficult urination came on, and after two days the urine became very bloody. This attack was considered one of malarial hæmaturia, and treated by quinine. The bleeding stopped, but difficult and painful urination continued. The symptoms became worse at irregular periods; they were made worse by "catching cold," by drinking whiskey in more than very small quantity, or by a change of drinking water. During the attacks patient has to urinate about every two hours. There is then pain in the left lumbar region and in the right groin, and at times pain radiating to the urethra. At the end of urination whitish particles are passed with the urine. They are more numerous two or three days after the attacks begin, but can be seen in the urine at all times. The urine has never had an ammoniacal color.

Patient denies venereal disease and coitus entirely. Smokes a good deal, drinks whiskey occasionally. Appetite good, bowels regular. Now feels fairly well, aside from the symptoms mentioned. Has lost about

eight pounds in the last year. The patient has consulted many physicians, some of whom have examined the urine. They have usually made the diagnosis of gleet and advised instrumental treatment, but, as the patient knew he could not have gleet, he has always declined. A few days before I saw the patient his urine was examined by a colleague, who informed me that there was in it a good deal of blood and pus. Boric acid and salol were prescribed.

Status præsens. Man of tall and slender frame; muscles small, but firm; panniculus scanty; no œdema. Skin dark and sallow; extensive capillary nævi on face and body; mucous membranes healthy looking. Examination of lungs, heart, and abdomen negative. No enlargement of spleen or liver. Examination by rectum negative.

Patient passes 25 c.cm. of urine without difficulty, and in full stream. This is pale yellow, clear, but with a number of small whitish flakes about the size of pin-heads, and a small amount of clear mucus in the last part. The urine is acid, sp. gr. 1020; no sugar nor albumin. The particles mentioned look like caseous bits, but are less opaque. Microscopically they are made up of pus corpuscles, bladder epithelium of all kinds, and a number of bodies slightly larger than pus corpuscles, of a peculiar amyloid appearance.

It was very soon apparent (at the first examination) that these were animal parasites, and, as I propose to describe them in full later, I omit the notes made at the time, as well as the full notes taken from time to time after that.

October 25th. Examination of blood: Blood flows freely, of good color and consistence. Hæmoglobin (Fleischl), 100 per cent.; red blood-corpuscles (Thoma-Zeiss), 5,860,000; leucocytes, 8333. Red corpuscles are of normal appearance and form good rolls. Leucocytes show normal differential count. No parasites found in the fresh or stained blood.

From this time the patient remained comparatively free from symptoms, though the particles were passed as before. From gratitude at the improvement, and scientific zeal, he enabled me to examine his freshly passed urine at frequent intervals, sometimes daily, and to make all the necessary examinations, inoculations, etc.

I discovered very early that the particles are of two kinds. Some are small, or rarely long and narrow; opaque, with distinct outlines. These are made up of pus corpuscles (polynuclear neutrophile cells, with a few eosinophiles). They rarely contain parasites. The others vary in size, sometimes being two or three millimetres in diameter. They are less opaque than the others, sometimes quite gelatinous looking. They are composed of large squamous epithelial cells, transition cells of various sizes, a few leucocytes, and parasites in variable numbers. Once I counted three hundred and fifty parasites in a single particle, which, when spread under the cover-glass, measured about 3 mm. in diameter.

November 15th the patient caught cold at a foot-ball game. That night he had pain in the back and frequent urination. Next day the parasites were more numerous than they had been for some time. In the night of November 19th the patient went out to urinate. He felt a sharp pain in the penis, and on returning to the house found some blood on his shirt. The next morning I found two or three blood-spots on the shirt. The urine contained a few red blood-corpuscles; parasites as before.

From this time the history of the case has been much the same.

There have been no severe attacks of pain. The patient rarely has to get up at night. He has gained fifteen pounds, and says he feels better than at any time for ten years. The urine usually contains a few small particles, nearly always with parasites, but sometimes without any for several days at a time.

After a mild attack of influenza, during which the patient took salol and phenacetin, the parasites were more numerous, but the symptoms were not so severe as they had been after previous temporary illnesses.

When I first found the organisms I thought I had discovered a new species. The characteristic features of the bodies I saw were not mentioned as belonging to trichomonas in the hand-books in my laboratory and I was not familiar with the recent and more accurate investigations. Fortunately, I was able to demonstrate the first specimen found to my colleague, Dr. J. Playfair McMurrich, who at once determined the genus. This has been amply confirmed since then by the observations I have made and the examination of the literature of the subject. I have been able to demonstrate the parasites to a large number of my colleagues in the medical department and the department of animal morphology, and to exhibit them alive at a meeting of the Journal Club (biological) of the University.

As regards the species I am in the same position as Marchand. The parasites I have studied agree with his descriptions more than with any others. He found slight differences as compared with tr. vaginalis, but not enough to lead him to give a new specific name. I have not been able since I found the bladder parasite to make examinations of tr. vaginalis. I think it better, for that reason, to describe the parasites as fully as possible, leaving the question of classification to other observers or the result of future comparative examinations.

My own examinations have been very numerous, and included the observation of the parasites alive under various conditions for hours at a time, almost daily for long periods, the study of the effects of reagents, staining, cultures, and inoculations. My microscopic observations were all made with Zeiss D D., and one-twelfth-inch oil-immersion lenses.

Zoological Classifcation. Trichomonas belongs to the flagellate infusoria. In the classification of Bütschli, one of the most rational which has been attempted as regards the form we are now considering, it is placed in the sub-order Isomastigoda and family Tetramitina. This family includes the closely related *cercomonas* Davaine, and *trichomonas intestinalis* Leuckart, which Bütschli includes under the generic name *monocercomonas* Grassi. According to the same author, about three species of trichomonas are known. All are parasitic, living in the intestines of frogs, snails, and other lower animals, and in the human vagina.

Grassi, as mentioned before, includes some of the species in his genus *Monocercomonas*; others in that of *Cimænomonas*. *Trichomonas vagi-*

nalis, with which he was not familiar, he thought might belong in the family he called Trichomonadidea; this, and his description of that family, gives conclusive evidence that his statements regarding his unfamiliarity with tr. vaginalis are true.

In the latest classification, that of Braun (*loc. cit.*, p. 108), the genus *Trichomonas* includes *tr. vaginalis* Donné, and *trichomonas hominis* Davaine. The latter includes *cercomonas hominis* Dav.; *cerc. intest.* Lambl (1875), Marchand; *trichomonas intest.* Leuckart; and *monocercomonas resp. cimœnomonas* Grassi.

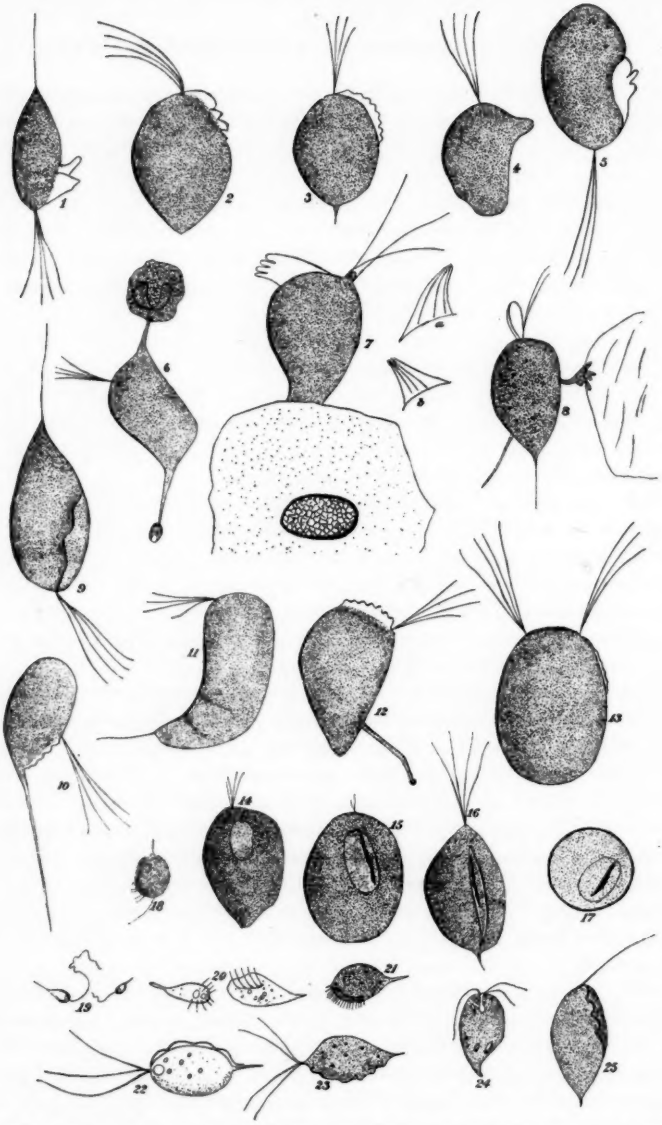
Evidently what is needed concerning the flagellate parasites is not so much classification and nomenclature as objective study. Braun deserves credit for restoring Donné's term, and is justified by the rule of priority, notwithstanding the imperfect description and etymological incorrectness of the French observer. The wisdom of including cercomonas in the same genus may be questioned.

Size, Form and Structure of the Parasites. Trichomonas vaginalis is said by all who give measurements to be from 15 to 25 m mm. in length, 7 to 15 m.mm. in width. The organisms found by Marchand and Miura in the urine were about the same size. A number of measurements in my own case showed that most of the bodies are from 15 to 22 m.mm. in length and 10 to 15 m.mm. in width, but a few are considerably larger and some smaller.

The form of the organism also agrees with the descriptions of others. The commonest or typical form is a pyriform or broad spindle with one end rounded, or the shape of an apple-seed or almond-kernel. Sometimes the broad end is in front, sometimes behind. Sometimes the bodies are elliptical or oval; sometimes irregular (see figures). Donné early described changes of form like those in a leech. Without knowing that, I had compared the appearance to that of a garden slug. Occasionally, as will be described later, the form is altered as the result of special motion. Usually the smaller specimens are more typical in shape than larger ones. The bodies appear to be flattened from above downward.

The general appearance of the organisms is sometimes peculiar, so that they can be distinguished by tint or refraction before the characteristic organs are seen. Light and amplification have much to do with these things; in general the bodies are difficult to distinguish from leucocytes or other cells of similar size in the preparation until the motion of their peculiar organs is recognized. The outlines are usually sharp, the structure finely granular, sometimes hyaline and homogeneous, rarely coarsely granular.

The protoplasm is not easy to differentiate into separate parts. Künstler claimed for tr. vaginalis the existence of a cuticular layer,[6] in addition to an ectoplasm. Marchand also describes a similar



Figs. 1–13. Trichomonas from the bladder. Drawn from different live specimens as seen with Zeiss 1–12th inch immersion objective and No. 2 ocular. Drawn approximately to the same scale and enlarged in the plate. For details see text.

Fig. 14. As stained alive in watery methylen-blue solution. Fig. 15. After fixing with sublimate and staining with methylen-blue. Fig. 16. Fixed by sublimate; stained with acetic-carmine. Fig. 17. Late stage after treating with acetic-carmine. Fig. 18. Trichomonas vaginalis as depicted by Donné. After HASSALL. Fig. 19. Cercomonas hominis. After DAVAINE. Fig. 20. Marchand's parasite from typhoid stool, 1875. Fig. 21. Zunker's parasite. Fig. 22. Trichomonas hominis. After GRASSI. Fig. 23. Cercomonas coli hominis. MAY. Fig. 24. Trichomonas intestinalis (Marchand). After ROOS. Fig. 25. Cercomonas hominis (Davaine). After Roos. Figures 18–25 are reproduced as nearly as possible in the sizes of the originals.

layer in the bladder parasite. I have never been able to demonstrate this, and the occurrence of pseudopods, to be described below, seems incompatible with a true cuticle. A differentiation into ecto- and endoplasm can, however, be made out, and the ectoplasm may in some cases simulate a cuticle. I have found the difference between the two layers well brought out by treating the organisms with (Gram's) iodine solution The endoplasm retracts slightly in some places, and stains deeply after considerable time, leaving a thin and faintly stained membranous layer outside. Both in unstained and stained specimens the inner layer of protoplasm has a finely vacuolated appearance when examined by high powers.

Small vacuoles or highly refracting granules can sometimes be seen in the bodies, but there is no contractile vesicle. This agrees with the statements of all who have examined tr. vaginalis. In the parasites I have examined I have never been able to recognize any particular inclusions such as bacteria, which others have found in tr. vaginalis. This may be due to the fact that the urine in my case seldom contained bacteria while under examination or while the parasites were still alive.

Effects of Stains and Reagents. The parasites are difficult and unsatisfactory to stain. The best results are obtained by staining alive, or by staining specimens recently killed by sublimate. Placed alive or after being killed by sublimate in methylen-blue solution, the parasites remain as clear bodies long after all other cells are deeply stained. Afterward the bodies become stained, and look coarsely granular or finely vacuolated according to the degree of amplification. In such preparations the nucleus appears as described below. Neutral-red is not as satisfactory as methylen-blue in staining live specimens. In dried preparations, fixed by heat, alcohol and ether, osmic acid, bichloride, or formalin, stains of all kinds are very unsatisfactory for the protoplasm, and usually also for the nucleus. In preparations fixed on the coverglass, and stained by methylen-blue, a spiral line can sometimes be seen, extending from the insertion of the flagellum or near it, a variable distance backward. This has been noticed by others. I think it an artefact, as it is extremely rare.

Strong sublimate solution (5 per cent.) has the effect of rendering the organisms motionless at once and making their protoplasm more granular, no doubt as the result of coagulation. It often produces contraction in the bodies, and especially causes the appearance of two highly refracting lines nearly or quite parallel, and in a direction similar to that of the nucleus. These lines I am quite confident are the result of contraction. They appear also under the influence of acetic acid. Similar appearances have probably led to the idea of internal organs, or of a "rib," or "keel" in or on the body.

Acetic acid, besides bringing out the nucleus, clears up the proto-

plasm. Later the bodies become round and numerous granules can then be seen. These are often in rows or lines, but do not have a definite arrangement, as some authors have described in tr. vaginalis.

In unstained specimens the nucleus cannot be seen. Sometimes, with low powers, a bright or dark spot, depending on the focus, can be seen near the front of the body, as is also the case with cercomonas. This I think is only the effect of the refraction of the body. By the use of reagents, however, the nucleus can be plainly seen, and its characteristics examined. The nucleus is always in the anterior part, usually lying somewhat obliquely. Acetic acid brings out in this part a round or oval, highly refracting body, which comparative examinations prove to be the nucleus. It appears some time later than the nuclei of leucocytes or epithelial cells in the same preparation. Sometimes the highly refracting nucleus is enclosed by two lines, as mentioned in speaking of the protoplasm (Fig. 16).

In preparations stained with methylen-blue alive or after killing with sublimate, an oval area appears, sometimes with a dark vesicular outline, sometimes with a diffuse stain deeper than that of the protoplasm, but less granular. At other times a clear vesicle appears, and in it a long deeply stained body, the nucleolus of many writers, more properly spoken of as the chromatin-body. Around this is a clear area.

The nucleus is best demonstrated by staining live parasites in acetic carmine. This clears up the protoplasm, brings out the nuclear-membrane, and stains the chromatin-body deeply and distinctly. It then appears as a long and narrow, somewhat irregular body. The lines on both sides of the nucleus are present in the beginning, but after a few hours the bodies become round, the contents clear, with the nuclear membrane and chromatin-body, as in Fig. 17. The nucleus is about one-fourth to one-third the length of the body of the parasite.

At the anterior end of the organism are the flagella, concerning the history of which a few words are necessary. Donné described only one of these, but said it was sometimes bifurcated. Scanzoni and Kölliker saw two or three. Künstler was the first to claim that four was the constant number. This was denied by Blochmann and Bütschli, but confirmed by Henneguy, and Marchand found this number in both the vaginal and bladder parasites, but agrees with Künstler in saying that it is not always easy to recognize all four. After very extensive observations on this particular point I agree with Künstler. Often only one, two, or three flagella can be seen, even in a prolonged observation on the live organism. This is especially the case when the parasites are active. If, however, they are suddenly killed, as with saturated sublimate solutions, four flagella can be distinctly seen. In specimens which die naturally, or sometimes in those killed with iodine, it can be seen that

one flagellum is thicker than the other one or two, as is not the case when all four are seen.

The length of the flagella in my examples varied from one to three times the length of the body. Usually these organs are about one and a half to twice the length of the body. The flagella seem to taper slightly from their insertion to the tips. Blochmann and Künstler have carried on an argument about the tapering of the flagella of tr. vaginalis, and Künstler, who asserts that they taper, admits that the appearance may be the result of transparency. (See Bütschli, *loc. cit*, p. 673.)

The flagella usually rise so close together that they seem adherent at the base, or to arise from a common pedicle. That they do not do this I am convinced by finding them separated at the base by a short pseudopod (Fig. 7) in one instance. Künstler held that the flagella arise from a sort of "rostral prolongation" of the body, a view which Marchand seems to support. In my own case I could find no evidence of it. The flagella have very clear outlines and a fine homogeneous structure. I could never see any evidence that they are sticky, as are the flagella of some other protozoa. I have made many efforts to stain the flagella, but without satisfactory results.

The posterior end of the body is sometimes prolonged into a long tail-like process. Donné no doubt saw this, as he said that the organisms fix themselves to the cover-glass, "not by suckers, but by a sort of viscous material which leaves a trail behind it." This appearance I have often seen. It seems to be due to the formation of a thin, soft, adhesive pseudopod. At other times a sharply-outlined tail is present, which may resemble a flagellum, but usually differs in its more granular structure and its less distinct outline, and also by its lack of flagellar motion. It is, moreover, capable of marked change of form, and is often retracted, or contracted and expanded, showing its close relation to pseudopodial structures. The tail is likely to be adherent to various objects in its vicinity—leucocytes, other parasites, or granules of broken down leucocytes. Not infrequently one can see two parasites attached by the tails, which often show curious changes of shape. This has led some to think the organisms undergo transverse division, but I have never been able to find evidence of the earlier stages of such a process. The most remarkable thing about the tail is that it may be absent from all the organisms examined for many days, and then be found on almost all examples in another specimen, so that when one finds one parasite with a long tail it is safe to predict that most of them will have them. In such cases a preparation containing a number of parasites presents a curious appearance, as if full of gigantic spermatozoa. It may be necessary to add that no error can be made between these two objects if one has other guides to the size of the organisms, as leucocytes in the field, or familiarity with the microscope, so that the grotesque fig-

ures in a recent work on *Medical Jurisprudence* are not necessary in order to avoid confusion.

The most interesting part of the parasite, in many ways, is the undulating membrane. Donné thought the organism he discovered had a row of short cilia on one side, near the anterior end, and this error was handed down from one observer to another, until Künstler confirmed Stein's assertion, based on the relations in the trichomonas of the frog, that the so-called ciliary comb was an undulating membrane. The discovery of Künstler was confirmed by Blochmann and Bütschli. In my own case, although usually visible, in some examples the undulating membrane could never be seen, so that I think it can be temporarily absent. I found it absent usually in those parasites which exhibited most marked change of form, and it seems probable that there may be some relation between the two things, so that one function can replace the other under certain circumstances. Stein was of the opinion that the undulating membrane of trichomonas is not a permanent structure, in fact not a true membrane, but is due to the alternate projection and retraction of a part of the body; but this is denied by Bütschli. Opinions differ as to the extent and insertion of the membrane in tr. vag. Künstler claimed that the membrane passes around the body of the parasite in a spiral line, being inserted in a sort of rib, but he admitted that it is only by a "lucky chance" that one can see the whole membrane. Blochmann, however, thought the membrane half as long as the body, and in this Marchand agrees with him.

I have never found the membrane more than two-thirds the length of the body, extending from the insertion of the flagella backward; often it is much shorter. The membrane is sometimes on one side of the body, sometimes the other. It may extend out from the side of the body or be turned over or under it, or it may arise from a straight or spiral line on the anterior surface of the body, facing the observer. No distinct line, ridge, or depression can be seen at its origin, and it often gives the impression of a gradual thinning out of the side of the parasite. The membrane varies much in width, and this variation is independent of the shape of the body. The outer edge of the membrane is sometimes thickened and so resembles a flagellum, but this is not constant. Very rarely have I been able to see the membrane prolonged to a point. Usually the posterior end tapers gradually to the side of the parasite. Owing to the fact that the outer edge is much longer than the insertion, the undulating membrane is always more or less zigzag, fluted, or scalloped, so that from the folds and the zigzags the appearance of a row of cilia is often very closely simulated. The membrane does not stain well.

The organisms I have seen have no signs of mouth or other digestive organs. Donné thought there probably was a mouth, but did not assert

it as a fact, as has been claimed. Blochmann and Bütschli could not find one. Künstler claimed to find mouth and œsophagus, and claims that Gasser (*loc. cit.*, p. 35) described the mouth as a *cavité cupuliforme*. Marchand could not find it in live specimens, but in stained ones he saw tubular structures extending forward from the nucleus. I believe that some observers have mistaken the appearance produced by the undulating membrane, as it plays along the middle of the body, for the mouth. In such a case a narrow clear space appears to be in the body at that part. Another thing which Donné perhaps thought was the mouth I have often seen. This is a shallow depression or cleft near the insertion of the flagella, which no doubt has the function of a mouth. At times one side keeps up a nibbling motion, which is very suggestive of a mouth. The appearance is not permanent, however, and is rather uncommon.

PHYSIOLOGICAL CHARACTERISTICS. The phenomena of motion presented by trichomonas are extremely interesting. The simplest is due to contractions of part of the body, with change of form, as Donné mentioned. This enables the organisms to change their position to a considerable extent, so that in a few minutes one may move across the field. Such extensive motion, however, is unusual, and the process is generally limited to jerking movements of the body in different directions.

Another process consists in the projection of lobes, usually combined with contractions, so that amœboid motion is simulated. True amœboid motion, in which, along with a projection of the ectosarc there is a flowing in of the endosarc, I have not seen, and the changes of form and position are never so great as in typically amœboid organisms. That this function indicates the existence of a cuticular membrane is not a necessary conclusion, as some zoölogists have claimed, but it can be brought about by contractions of the outer layer of the plasma or of the plasma as a whole (Bütschli, *loc. cit.*, 849). I have also seen another process, mentioned by Blochmann and by Künstler. This consists in the appearance of a scalloped edge on one side the body, with a wave-like motion running along it. I have only seen this in dying organisms and take it to be peculiar to that stage.

Another function exhibited by trichomonas consists in the formation and motion of pseudopods. My observations indicate that this is an important function. Künstler and Marchand seem to be the only observers who have noticed pseudopodial formation in trichomonas, but I have been fortunate in seeing it oftener and more specialized than they seem to have done. It can occur in any part of the body. In the simplest form short knob-like projections appear on the body. (Fig. 7.) Much more frequently a long narrow process is formed, usually becoming fixed to something in the vicinity. (Figs. 6, 8, and 10.) Pseudopods

of this kind often serve as organs of support. So in the parasite from which Fig. 12 was taken, the end of the process was fixed to the cover-glass like a sucker. The animal then made rapid and abrupt bobbing movements resembling a duck diving for food. The pseudopod at such times bent at an angle, always in the same place. The body of the parasite at the same time changed its shape considerably, so that the undulating membrane, which, at first, ran down over the back, came to be in front. At times a tail was present. At the anterior end a cleft often formed, and exhibited the nibbling motion in its sides, as mentioned above. The flagella and membrane were in active motion all the time. The narrow pseudopods expand and contract at times in different parts. The most remarkable pseudopodial action I have seen is depicted in Fig. 8. A similar process was seen several times. Here a pseudopod was passed over or under the side of an epithelial cell. The end then expanded and became branched, resembling a very irregular minute amœba. The lobules of the extremity then kept up a constant and somewhat rapid amœboid motion, resembling precisely that of an endoglobular malarial parasite. Sometimes the ends kept up a rhythmic motion, giving a revolving effect. This pseudopodial function seems to be an important one in the nutrition of the parasite, especially when for any reason the flagella and undulating membrane cannot act.

The motion of the flagella is whip-like usually, but, at times, spiral, the waves always running from the insertion to the tip. Motion is not directed always in the same direction, as claimed by some in the case of trichomonas vaginalis. Sometimes the motion is toward the side of the undulating membrane, again toward the opposite side. Usually it is directly forward. Sometimes one flagellum has a different direction from the rest, bending down along one side, or across the body. Sometimes a flagellum turns down along one side, and, without touching anything, acts as a point from which the whole body moves, apparently as the result of a powerful action of the flagellum. By their ordinary motion the flagella produce a current toward their insertion, causing granules in the fluid to shoot with great velocity against the anterior end of the body. At such times the appearance of a mouth is often produced, the granules apparently being taken in by stomata which form and disappear.

The motion of the undulating membrane is usually a waving one from before backward, due to the ciliary motion of the edge; sometimes the motion is apparently spiral. The rapidity of the motion varies very much, and this, with the difference in the width of the membrane, gives great variety to the appearances presented. Sometimes close folds are produced, sometimes zigzags advance and retract along the edge, and often the membrane seems to be actually revolving, like the arms of a windmill. Sometimes the general direction of the membrane is greatly altered, as shown in Fig. 7, *a* and *b*.

The membrane also produces a current which runs toward the anterior end, carrying floating granules with it.

That the membrane, as well as the flagella, acts as an organ of locomotion seems likely, but I have never seen it. Even in the hanging drop on the warm stage I have never seen the parasites swimming freely. In this respect they offer a marked contrast with cercomonas Davaine. According to Künstler the undulating membrane acts as a locomotor organ when the parasites are closely surrounded, enabling them to move as a serpent does.

The trichomonas, as I have found it, is extremely sensitive to external conditions. Kept in an incubator, in the urine as passed, the parasites remain alive and active for six or seven hours. In the usual room temperature they die an hour or two earlier. Organisms dying in this way often show a few short, straight, hair-like processes on various parts of the body. These are not bacteria, but are most probably like the similar processes sometimes present on dead or dying cells of various kinds.

If a preparation containing parasites is examined from time to time without allowing it to evaporate the organisms completely disappear, and nothing remains that can be recognized as derived from them. The same is true of specimens kept in an incubator for twenty-four hours or more.

Cold is injurious to the organisms, so that on the slide in a cold room little or no motion is seen, but if the room is warmed, or the preparation put on a warm stage, motion soon becomes active. All the phenomena of motion are marked at a temperature of 80° F., more active still at 98°, but cease in a few minutes if the warm stage is heated up to 120°.

When the organisms are becoming sluggish from long stay out of the body they cannot be revived by heat. The addition of dilute alkalies, which stimulates some protozoa, has no effect on them, but stronger solutions are injurious.

The organisms occur always, as I have said before, in acid urine. Künstler has called attention to the fact that trichomonas vaginalis also lives in an acid medium, a fact on which Donné laid considerable stress, and which seems to have few exceptions, Haussmann saying they occur in alkaline secretions, though not in large numbers.

As the parasites are anærobic—as Künstler showed tr. vaginalis to be—I made an effort to grow them in that condition. I was fortunate in getting my friend, Dr. F. G. Novy, to make some trials with the admirable apparatus devised by him (*Centralblatt für Bakt. und Parasit.*, 1893, Bd. xiv. p. 581). We tried urine, as well as numerous culture solutions, but without effect. The parasites disappeared just as they did when exposed to the air.

Mercuric chloride kills the motion and at the same time fixes the organisms. Compound solution of iodine also stops motion of all kinds at once.

When the bodies are dropped into saturated solution of sulphate of quinine the motion of the flagella and of the undulating membrane stops at once. In a few (three) minutes the bodies swell out and become clear, with bright granules scattered through them, sometimes arranged in lines. The bodies are very soft, as shown by the indentation produced by other bodies pressing on them. A little later the flagella and undulating membrane begin a spasmodic jerking motion. The bodies become larger and larger, the undulating membrane very narrow. Hyaline vesicles break out from the sides of the swollen bodies. The motion of the flagella sometimes lasts for an hour, by which time, however, the bodies are usually only large collections of clear vesicles. The process here seems partly poisonous, partly due to imbibition as the result of paralysis. Water alone does not produce the vesicular change so rapidly.

Salicylic and boric acids cause similar changes. No appreciable difference in rapidity can be seen in the action of these various drugs.

Efforts to grow the organisms in the bodies of animals failed. I first tried the vagina and bladder of guinea-pigs and rabbits. As the urine of these animals is very alkaline I used a large bitch. After the first trial under chloroform it was possible to catheterize the animal without an anæsthetic, so that the experiment was quite simple. Although a vaginitis and mild cystitis occurred from intentional irritation with the end of the (glass) catheter, no flagellates appeared as the result of numerous injections of epithelial bits containing active parasites. The dog's urine, however, though acid, is not identical with that of man, so that I do not consider the experiments very conclusive. Experiments on man could not be made.

Reproduction. It is generally admitted that all flagellates multiply by longitudinal division, although some have other methods besides. Künstler and Marchand have observed longitudinal division in tr. vaginalis, the latter finding frequent evidence of it. In my experience the process has been very rare. I have seen it only twice, once in a preparation stained by acetic carmine, and once in a live specimen. (Fig. 13.) In the latter, a very large body, there were two sets of flagella and two undulating membranes, one being between the sets of flagella. In trying to stain the organism alive I lost it. (It might be thought that this figure represents a copulation-process. From what we know of this among the flagella, however, such is not the case.)

Of the formation of "dauer" spores, etc., in trichomonas, nothing is known, but from the number of parasites often present in my case and the scarcity of dividing bodies it seems there must be some other method of reproduction than that by division.

Mode of Infection by Trichomonas. From our present knowledge of the distribution of trichomonas it is impossible to explain its mode of entrance in man. The most probable explanation is that it exists in some other form, perhaps in water or on plants, and gains entrance to various animals in that way. The theory of Cunningham that both cercomonads and trichomonads are nothing but zoospores of amœbæ, inviting as it is, has not been confirmed. Perroncito,[50] who has made a special study of cercomonas, claims that it becomes encysted, forming "dauer" forms, which are more resistant to external influences than the active forms, and are readily transported, and so enters the human body. May thought his patient had been infected by drinking-water, and Epstein brings almost conclusive proof that the organisms found by him entered the body in the drinking-water. He noticed, for example, that sucklings who never drank water never had the protozoan diarrhœa. At one time three children in one room got the disease simultaneously. A fourth child in the same room, by reason of his condition, drank no water. After demonstrating that the stools of this child were free from flagellates, he was given in the course of twenty-four hours 250 c.cm. of water from the pump from which the other children were supplied. On the same day flagellates appeared in the stools, which soon became watery, were forcibly ejected, and later showed large numbers of parasites. The so-called monocercomonads could not be found in the water, nor any form with which they could be supposed to have relationship. (It is an interesting fact that the water in question came from the pump used by the patients with amœbic dysentery reported some years ago by Hlava.[51] Epstein makes the important statement that amœbæ have been found in that water.)

It is, of course, possible that the water contained organisms in numbers too small to enable them to be discovered. Whether that is true, or that the organisms existed in the water in another form, their prompt appearance in the stools of Epstein's patient is a noteworthy fact, indicating rapid reproduction under favorable circumstances. It is easier, however, to imagine how organisms of this kind can enter the intestine than to explain how they enter the vagina, especially since injections of ordinary water kill the developed forms. Balbiani (cited by Henneguy[7]) thinks that the flagellates may be swallowed in water, set free in the intestine, and wander from the anus along the perineum into the vagina, as does oxyuris. If Schuberg is correct in thinking the flagellates almost constant inhabitants of the intestine, this theory would have much in its favor.

In the cases in which flagellates were found in the urine of men the question as to mode of entrance is extremely interesting. In Künstler's case one can suppose the organisms came from the intestine and gained entrance to the bladder through the perineal wound. If in Marchand's

case there really was a rupture of the intestine into the bladder, as the history makes probable, we should have important evidence regarding the intestinal flagellates, as well as a ready explanation of the mode of infection. If, on the other hand, as Marchand thinks, there was an infection of the urethra, as happened in Miura's case, the manner of infection is clear, but the question arises why such urethral infection is not more frequent in places where trichomonas vaginalis is as frequent as some authors have found it. (Scanzoni and Kölliker in more than half, Haussmann in as many as forty per cent. of women examined, Künstler in nearly all women who had leucorrhœa and did not use injections.)

In my own case the relations seem to be unique. Not only the assertions of the patient, but also the characteristics of the urine, exclude infection by the urethra, and I think we must admit that the parasites reached the urinary tract indirectly. Such an event is, of course, no more remarkable in itself than many well-established facts in pathology.

Pathological Importance of the Flagellates. The question remains, have the organisms under discussion any pathogenic powers or are they simple "commensals?"

When Donné first reported the existence of trichomonas vaginalis he thought it characteristic of venereal blennorrhagia, though he did not commit himself to the belief in its casual relation. Later, he thought the organism had no specific importance, as he found it in muco-purulent discharges due to irritants of all kinds, *e. g.*, pessaries. Scanzoni and Kölliker thought the parasites had no specific action, but believed they were never found in the normal vaginal secretions. Künstler thought they must have pathogenic action, but not of a specific kind. The prevalent opinion among recent writers is that the organisms are accidental parasites in the vagina and mere "commensals." Here, of course, the organisms are never alone, but always accompanied by bacteria, many of which are pathogenic, so that it is impossible at present to assert that the animal parasites produce the disease with which they are associated. This does not imply that they have no pathogenic action.

As regards the intestinal parasites, the general opinion is that at the most the flagellates can by their presence keep up a diarrhœa which furnishes favorable conditions for their development. Many writers, especially Cunningham, Grassi, and Schuberg, think the organisms common parasites of the intestine. The clinical observations of Epstein, however, show that at least some of the intestinal flagellates can produce diarrhœa in man, and Perroncito (*loc. cit.*) claims that a species of intestinal cercomonas causes a fatal disease in guinea-pigs.

In the cases of Künstler, Marchand, and Miura the flagellates were associated in the urine with bacteria, so that no conclusion can be drawn as to their relation to disease.

In my own case the conditions were simpler and seem to me to require a revision of the whole subject.

The patient has had for some months, while under observation, a peculiar pathological process in the urinary tract, presumably in the bladder. It is probable the condition has existed for many years. This process is distinguished by an exudation of leucocytes and a desquamation of epithlial cells such as occurs in many cases when there is local disease in the organs concerned. So, for example, a tubercular nodule, a localized gonorrhœal infection might have such results. In this case, however, there is no sign or history of stone and no sign of bacterial infection. Culture experiments, repeated under various conditions, ærobic and anærobic, show no bacteria at all, and bacteria are invariably absent from cover-glass preparations when pains are taken to exclude contamination from the outside of the body. I am therefore forced to the conclusion that the parasites have produced the anatomical alterations, the evidence of which is so clear.

There is another feature which deserves consideration—the hæmaturia. Although this has not been excessive since the patient came under my observation, it has at least been at times out of proportion to the exudation. It must be remembered that since the patient has been under my care remedies have been used, more or less regularly, which must have a harmful effect on the parasites and lessen their activity.

I have in another place (*Hare's System of Practical Therapeutics*, vol. ii. p. 356) expressed my doubt regarding the malarial nature of certain cases of hæmaturia occurring in the Southern States. When in Texas, besides cases of undoubted malarial hæmaturia, I saw others which showed no evidence of malaria. It is well known that there is an apparently endless controversy regarding the treatment of such cases, a fact in striking contrast to the conditions in other malarial diseases. I did not see these cases under circumstances favorable for investigation, however, and often had to be satisfied with the examination of specimens sent a long distance. I suggested that some of these cases might be due to filaria or to Bilharzia, although I could find no positive evidence. In the light of the case now reported I do not think trichomonas can be left unconsidered in future investigations on this important subject.

In connection with this it is interesting to recall the cases in which amœbæ were found in the urine, reported by Baelz,[52] Jürgens,[53] Kartulis,[54] and Posner.[55] These are important clinically and anatomically because in three cases there was hæmaturia, and in the fourth (Jürgens), the clinical details of which are wanting, hemorrhagic lesions in the bladder. This was the only case in which an autopsy was obtained. (Posner's case was the only one remaining alive.) Jürgens found small cysts in the thickened bladder-wall full of amœbæ. In Posner's case there were

evidences that the kidney was affected, without signs of disease of the bladder. Posner thought the amœbæ had become encysted in the kidney, and so caused hæmaturia and nephritis. In this case, the only one observed for more than a short time, the patient had five attacks of hæmaturia in the course of several months. In the case of Baelz, a girl with tuberculosis of the lungs and genito-urinary tract, amœbæ were found in the vagina, and the observer thought they had entered that organ in washing, increased there, and then gained entrance to the urethra and bladder. In Jürgens's case, also a woman, bodies were found in the vagina which seemed to be earlier forms of the parasite. Posner thought that in his patient, a man, the parasites had entered the urethra and travelled up.

Two things must be borne in mind in considering the pathological relations of trichomonas. In the first place, we cannot assume that this is a harmless parasite always, because of its occurrence in comparatively mild diseases of the vagina and intestine, for organisms innocuous on such surfaces might in the bladder, ureter, or kidney set up severe or dangerous processes. Here I recall the finding of several hundred parasites in one small bit of epithelium on one occasion, strongly suggestive of cysts such as Jürgens found in his amœba case.

In the second place, we must remember that this parasite is not necessarily as rare as the few cases reported might seem to indicate. The history of the amœba coli and that of the malarial hæmatozoon show the need of caution in this respect, and the trichomonas, like the other organisms just mentioned, can only be found if the substance containing it is examined under favorable conditions. That I found the bodies I attribute to the effort I always make to examine urine as soon as passed, a practice of great value in many ways. Experienced microscopists had examined the same case, but without taking that precaution, and without success.

The precise place of trichomonas in pathology can of course be fixed only by further observation and experiment. If I am wrong in attributing to it a pathogenic power it does not possess, I feel that my observations on it have at least some value as a contribution to the biology of the flagellate protozoa.

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CRANIOTOMY (CRANIECTOMY) FOR IDIOCY.

By Charles L. Dana, A.M., M.D.,
of New York.

It is with some hesitation that I present the subject of craniotomy for the relief of idiocy and imbecility, for I find that the operation is not approved of by many, and has in a considerable degree fallen into disrepute and disuse. At the last meeting of the Congress of German Surgeons, Professor Bergmann, in his address on "Brain Surgery," made no mention whatever of this operation. At the last International Congress, Professor Jacobi, under the title *Non Nocere*, protested in vigorous language against the tampering by surgeons with the skull-caps of idiots. Quite recently Dr. Barbour, of Louisville, read a paper before the Louisville Medical Society on "Linear Craniotomy." He drew some unfavorable conclusions, and concluded with the Biblical injunction, *Mene, mene, tekel, upharsin.* Dr. Vance, in the subsequent discussion, stated that "the bottom had fallen out of the operation." Some two years ago Bournville, of Paris, published a long and elaborate article in which he showed, with a degree of explicitness quite unnecessary, in my opinion, that craniotomy does not and cannot affect the development of brains in which there are large cysts or in which portions of the brain are replaced by fibrous scars and sclerotic overgrowth.

All this would surely be sufficient to deter one from further study or practical utilization of craniotomy if it were not that certain other facts exist which must still be taken into consideration. It has so happened that in my personal experience I have seen idiotic and epileptic chil-

dren become better after the operation, and, very naturally, a few personal observations carry much greater weight than the opinion of even the most learned; then, again, through the skill and ingenuity of Dr. Seneca D. Powell the operation has been robbed of nearly all of its dangers, and has therefore been placed upon quite a different basis. While two years ago the mortality of the operation was placed by Starr at about 40 per cent., and while Dr. Keen, of Philadelphia, in 1891 stated that before operating he should explain to the parents that about one in four dies, the mortality rate now has been decreased to 5 per cent., or even less; so that one can at the present time say to the parents that only about one in twenty or twenty-five dies. In addition to this, a review of the cases that have recently been collected, more particularly those by Dr. Louis Masson (*Craumatismes Craniens*), shows a percentage of improvement of which one can hardly ignore the importance, even if the amount of this improvement is not very great. In another recent monograph by Ackermann (*Sammlung Klinische Vorträge*, 1894), the operation is reviewed, and the utility of it in proper cases is advocated. We also find words of support for the operation in the writings of Horsley, Keen, Starr, and Roswell Park. Therefore it seems to me that in the light, particularly, of the advance made in the *technique* which has led to the practical innocuousness of the operation, we should still continue to use it and keep up our studies upon it for a longer time. While I do not deny that five years from now we may possibly again lay it aside and say it is absolutely of no value, yet it would be unjust to our art and inhumane to a large class of most unfortunate sufferers to let the matter end here. I therefore beg to present the record of my own experience and the more recent cases of others.

Case I.—Harry McN., aged four and a half years. This boy was an inmate of the New York Infant Asylum; he is therefore illegitimate, and nothing is known of his history up to the first year of his age. He was rachitic; his fontanelles were all tightly closed by the third year. During the first three years of his life the boy suffered with general convulsions, three or four such attacks occurring weekly. Up to the time of operation he was unable to swallow except when in a semi-recumbent position, and he could only take liquid food. He could not say a word and could barely express a thought. His senses of sight and hearing, smelling and tasting were preserved. He could walk and use his hands, though clumsily. Measurements of the head, March 23, 1892, showed the following:

Great circumference	45½ cm.
Naso-occipital arc	30 "
Naso bregmatic arc	12 "
Bregmato-lambdoid arc	11 "
Lambdo-occipital arc	7 "
Binauricular arc (through bregma)	29 "
Binauricular arc (through lambda)	26.5 "

He was operated upon by Dr. Powell on March 25, 1892, and a long, linear craniotomy was performed on the left side, with two lateral branches running from the antero-posterior furrow. The child recovered from the operation without very much trouble. Within three weeks from the time of it he began to show symptoms of improvement in swallowing and in mastication. He also very soon began to talk, and there was noticed by the nurses a very striking increase in the child's intelligence. The boy was shown to the New York Neurological Society about a year after the operation, and I have recently another report of his condition dated as late as June 24, 1894. The measurements of the head show some increase in the great circumference, as the figures here given will indicate. The general opinion, both of the nurses and the house physicians at the time of the operation and for some months afterward, was that the boy had improved in a very striking way. He has had no epileptic fits since the operation; these, however, had ceased for some time before the operation was performed. Measurements of the head, June 24, 1894, showed the following:

Great circumference	47½ cm.
Naso-occipital arc	31 "
Naso-bregmatic arc	12½ "
Bregmato-lambdoid arc	11½ "
Lambdo-occipital arc	7 "
Binauricular arc (through bregma)	30½ "
Binauricular arc (through lambda)	27 "

Case II.—Beulah W., aged three years; only child, born at full term, normal labor. She soon developed convulsive attacks and by the third year had many weekly. She was idiotic, could not talk, and barely recognized her parents. Was noisy, constantly crying and screaming, and a source of great distress and care to the parents. She could not walk, and the legs and hands showed some rigidity. Head measured 47 cm. in great circumference. The patient was brought to me by Dr. Thomas H. Burchard, and was operated upon in the spring of 1891 by Dr. Robert Abbe, who did a linear craniotomy with lateral branches on the left side. The child made a good recovery. The parents removed a few months afterward to the West, but letters from them and a personal statement from Dr. Burchard dated a year and a half after the operation show that she was very much improved. The improvement consisted in an entire cessation of the epileptic fits for a period of at least six months, and a cessation of the horrible and continuous cries and tendency to noisy violence to which the child was subject.

Case III.—Harry P., aged two years and nine months, was brought to me for examination by Dr. Titterington, of this city. His family history is good. The child was born at full term and was the first child; head presentation; no instruments; no asphyxia. The child seemed well up to the age of six months. Then the anterior fontanelles closed and evidences of idiocy and defective mental development appeared. The child has never walked and cannot say a word; cries considerably, but is not violent or bad-tempered; sleeps well; has no convulsions; cannot sit up nor use its hands; spastic condition of all extremities. Measurements of the head show:

Great circumference	46.5 cm.
Naso-occipital arc	35 "
Naso-bregmatic arc	12 "

The child was operated upon by Dr. John R. Conway, of this city, at Bellevue Hospital, in July, 1893. Dr. Conway did a linear craniotomy on the left side in the usual way. A good recovery followed. A report as to the mental condition was given in December, 1893. Dr. Conway, who had seen the case, wrote me then: "The case of craniotomy is doing well and has improved greatly. Before she left the hospital there was a very decided improvement. The constant movement of the limbs ceased altogether; she became more intelligent in appearance, did not cry out aimlessly as she had been doing, but was quite docile and intelligent-looking. Another improvement was that she could take her food out of a spoon or glass, whereas she had never used anything but a nursing-bottle before." It had been understood that, if necessary, a second operation would be performed in the following year, and this operation was done on May 8, 1894. At that time I saw the child for a short time, and the same general statements about improvement were made. Measurements of the child's head at that time were not completely taken. The great circumference measured on the unshaven scalp was 47 cm. The previous measurements quoted above were made upon the shaven scalp. There was, therefore, a growth of the brain in the course of ten months equivalent to 1½ cm., allowing for the hair. A further report of the case is given me by Dr. Conway, dated April 2, 1895. Dr. Conway writes that the child left the hospital after the second operation in May, 1894. He was seen November 1, 1894, and was then walking alone and talking fairly well. This was also Dr. Titterington's report, and he was examined by him at that time. The child, it will be recalled, was unable to walk or talk at the time of the first operation in July, 1893, and it seems fair to infer that some of the very marked improvement in the child's development was due to the surgical operations.

Case IV.—Theresa S., aged eight and a half years; first child, born naturally, head first; long, but not difficult labor; no asphyxia; no convulsions; child born alive. Teeth at seven months; walked in second year. Had a fall out of a high chair on her face when thirteen months old. Three weeks later began to have epileptic seizures. She would suddenly straighten her limbs, bend her head forward, chin drawn down, hands extended. This lasted for a moment. There were several daily for several weeks. During this time she was in a dull apathetic condition—no pain. Then she became irritable, noisy. She did not walk or notice things. Since two years past she has been getting somewhat better, but is still idiotic. She understands a few words and simple directions. Can't dress or feed herself. Is restless and noisy; eats and sleeps well. Has seizures—two or three daily—then goes for two or three weeks or a month without any. She can see and hear. Has no paraplegia. Teeth bad; weight good; height good. Head small, great circumference 48.5 cm.; naso-frontal arc 31 cm.

November, 1893, Dr. Powell did a linear craniotomy on the left side. No improvement. June 6, 1894, operation repeated on the right side. A year later, absolutely no improvement.

Case V.—S. B. This patient was a child, aged five years; good hereditary history, except that a maternal uncle had a brain tumor. Birth normal; no instruments. Has developed slowly both physically and mentally, and is now imbecile and aphasic. The child has all the stamp of an idiot: bad teeth, deformed ears, small, irregular pupils,

peculiar shaped head. The child was operated on and died within twenty-four hours after operation.

Case VI.—A boy, aged seven years; Italian parentage. Parents healthy; birth normal, as far as could be ascertained. The child developed slowly, showing ordinary signs of imbecility; epileptic convulsions also appeared. There was no hemiplegia or paralysis. The head was irregular in shape, but of average size. The child was operated on by Dr. Robert Abbe and made a good recovery, but there was no improvement in mental condition nor in epilepsy noted six months after the operation.

Case VII.—A child, of German parentage, aged seven years, was sent to me by Dr. Carl Beck. He gave a history of imbecility and epilepsy, and the child presented the characteristics of these cases, but without any paralysis or hemiplegia. The head measurements were slightly below the normal, but there was no microcephalus. The child was operated upon by Dr. Carl Beck and made a recovery. He was seen by me six months later and there was no change either in the epileptic convulsions or in the mental state.

Cases VIII. and IX. were children, aged two and a half and three years, one with epilepsy-idiocy, the other idiotic and hemiplegic. Both were operated upon and both died.

Cases X. and XII. are patients operated upon within the past six months and it is too early to make a report upon them. One of them, a child, two and a half years old, idiotic and epileptic, operated on in April by Dr. Powell, now has no fits and is brighter and more docile.

Out of the above 12 cases there were improved, 3; not improved, 5; died, 3; doubtful, 1.

Cases Reported by Other Observers.

Starr's statistics[1] bring the list of reported cases up to the early part of 1893. He then collected 34 cases, and added two more of his own, making a total of 36. Among them the deaths were 15, or nearly 42 per cent.

Among the remainder there was improvement in 15, and no improvement in 6. Among the improved there was *great improvement* in three. The improvement consisted in diminution of fits and paralysis and increase of mental power.

The reports of improvement were made: 1 year, 1½ years, 3 months, 6 months, 9 months, 2 years, 1 month, 2 years, 1 month, 2 months.

Since the publication of Starr's table, cases have been reported by Dr. Emory Lamphear. (*The Journal of the American Medical Association*, 1894, p. 783.)

Case I.—Microcephalic idiocy. Harry A., aged four years. Could not talk, idiotic, walked imperfectly, had convulsions frequently, small head. Craniotomy, May 12, 1892, and again, June 18, 1892. Boy improved rapidly. In August could walk and say words. Last report in 1893; still improving; no more convulsions.

[1] Brain Surgery, 1894.

CASE II.—Henry B., aged six years. Congenital idiocy, convulsions. The child was absolutely idiotic, could not walk or talk, or even masticate its food. Craniotomy. Report seven months later: very unexpected and surprising improvement; quieter, eats well, says a few words, fewer convulsions.

CASE III.—Boy, aged twelve years. Epileptic idiocy The boy was well developed. Epilepsy began at three years and six months, and was mainly hemiplegic. Right side less developed. Craniotomy. No improvement.

CASE IV.—Boy, aged six years. Traumatic epilepsy. Operation; death.

CASE V.—Hydrocephalic idiocy. Lydia W., aged four years and six months. At five months hydrocephalus and convulsions began. Child became completely idiotic. Operation; convulsions disappeared; not much change in mental condition.

CASE VI.—Idiocy. Boy, aged four years and six months. Operation; death.

Dr. Lamphear's conclusions are that the field for craniotomy is a limited one, but in this field some help can be given.

L. Masson, in his work entitled *Des Traumatismes Craniens*, Paris, 1894, goes over the entire literature of the subject and collects many cases from French periodicals which I have not seen referred to elsewhere. I record them in the briefest possible manner.

CASE VII.—Microcephalous idiot. Female, aged three years. Craniotomy; three months later improved; head larger. (J. Ransohoff, *Medical News*, June, 1891.)

CASE VIII.—Microcephalous idiot. Male, aged three years. Operation; one year later marked improvement; head larger. (Corné, *Normandie Medical*, August 15, 1891.)

CASE IX.—Idiocy. Male, eight months. Spastic diplegia, microcephalus, optic neuritis; premature ossification of cranium. Operation; improvement marked and progressive. (Miller, *British Medical Journal*, No. 1647; *Arch. de Neurol.*, vol. xxv.)

CASE X.—Microcephalous and choreic idiot. Male, four years. Operation; improvement reported in three weeks. (Wyman, *Medical Times and Register*, October, 1, 1892.)

CASE XI.—Chemieux (*Congr. für de Chir.*, vi., session 1892). F., four years and two months. Idiocy, microcephalus. Improvement.

CASE XII.—Reboul (*Arch. Prov. de Chirur.*, June, 1893). M., idiocy. Microcephalic contractures, athetosis, etc. Craniotomy; removed a serous cyst in frontal region; death.

CASE XIII.—Bernard Joos (*Corresp. Blatt. für Schw. Aertze*, March 15, 1893). M., aged three years and nine months. Idiocy; microcephalus; two craniotomies; five months later great improvement reported.

CASE XIV.—Largeau, V. (*Cong. für de Chirur.*, 1892). M., 3; microcephalous idiot; great circumference, 45 cm.; operation; slight improvement.

CASE XV.—Blanc (*Ann. de la Société de Saint Etienne*, 1893, t. 11). M., 7½; microcephalus and idiocy; operation; very great improvement reported three years later.

CASE XVI.—Kurz (*Wien. med. Presse*, October 23, 1892). M., thirteen months; idiocy; microcephalus; operation; two months later head measures 1 cm. more in great circumference; improvement.

CASE XVII.—Jaboulay (*Arch. prov. de Chirur.*, February, 1893). M. 13; idiocy; operation; six months later slight improvement; fewer cries.

CASE XVIII.—A. Broca (*Congr. franc. de Chirur.*, 1891). M., 18; imbecile; monoplegia and Jacksonian epilepsy; operation; six months later slight improvement.

Dr. John F. Barbour (*Journal of American Med. Association*, March 30, 1895) tabulates 89 operations; deaths, 16; no improvement, 20; improved, 48; unknown, 5. He reports one case.

CASE XIX.—Infant, with premature closure of fontanelles; idiocy; epilepsy; operation; no improvement reported two years later.

CASE XX.—Dr. Vance in the same number of the *Journal* reports the case of an idiot, aged nine years; operation; death.

CASE XXI.—Dr. F. Dumont reports the following: Infant, fourteen months; microcephalous idiot; naso-occipital arc 23; operation by circular craniotomy; two months later improvement in motility and intelligence. (*Correspond. bl. f. Schw. Aertze*, 1893, No. 23.)

Dr. J. H. Ackermann, of Stockholm, reviews the subject in *Sammlung klin. Vorträge*, Leipzig, 1894, No. 90. He collects fifty-seven cases, not including (as Dr. Barbour does) Lannelongue's.

CASE XXII.—M., aged two years and six months; microcephalous and epileptic idiot; two operations; no improvement.

SUMMARY.

	Total.	Improved.	Not improved.	Doubtful.	Died.
Starr's collection . . .	36	15	6	...	15
Personal (Dana)	12	3	5	1	3
Lamphear	6	2	2	...	2
Masson's collection . . .	12	8	...	3	1
Barbour-Vance	2	...	1	...	1
Dumont	1	1			
Ackermann	1	...	1		
	70	29	15	4	22

Leaving out the older collections, including Masson's, in which mortality is too high and improvement too frequent, we have the following:

Total.	Improved.	Not improved.	Deaths.
22	6	10	6

This represents, in my opinion, fairly well recent results.

The death-rate above given is about one-third, but this, as before

stated, is not a correct representation of the dangers of the operation. When properly done the death-rate should not be over 5 per cent.

The Pathology of Idiocy and Rationale of Craniotomy.

The pathological changes in the brain which cause idiocy and imbecility have been frequently described, and need not be dwelt upon here, except so far as concerns the class of cases for which the operation of craniotomy is most indicated.

The changes and corresponding classification made by Bourneville are these:

1. Idiocy from agenesis, or simple defective brain development. These include most of the microcephalic cases.
2. Idiocy from localized atrophies, sclerosis, cysts.
3. Idiocy from tuberous or hyperplastic sclerosis.
4. Idiocy from hydrocephalus.
5. Idiocy from myxœdema.

There is another general classification of idiocy suggested by Dr. H. Piper, which, while not perfectly exact, answers a practical purpose:

1. Idiocy without epilepsy and paralysis (congenital),
2. Idiocy with epilepsy and paralysis (acquired).

Now in a general way it may be said that the simple idiocies without epilepsy and paralysis (as hemplegia or paraplegia) are prenatal in origin, depend upon hereditary influences, and are oftenest associated with some degree of microcephalous. They correspond to Class 1 of Bourneville.

The idiocies that are associated with fits and palsies are most often due to accidents at the time of birth or to injuries and infectious fevers, leading to cerebral hemorrhages. In these cases the head is usually of average size, or slightly below it.

Following the statistics of H. Piper, Superintendent of the Idiot Asylum of Dalldorff (Berlin, 1893), we find the following facts as to the predisposing causes of idiocy:

In congenital idiocy, the proportion of males to females was two to one; in the acquired form, three to one. In both forms, therefore, the male sex predominates decidedly. Taking the first type of idiocy (congenital), we find the following percentages:

In 23 per cent. there was phthisis in the parents or ascendants; in 14 per cent. there was insanity in the parents or ascendants; in 10 per cent. the father was a drunkard; in 7 per cent. there was epilepsy in one parent; in 5 per cent. there was syphilis in one parent; in 4 per cent., mother nursed the child during pregnancy; in 4 per cent., idiocy in ascendants; in 3 per cent., parents were blood relations; in 2 per cent., accident to the mother.

In the second form (acquired idiocy), the following percentages were noted:

In 27 per cent. the child had suffered from scarlatina, diphtheria, or typhoid fever; in 11 per cent., measles; in 9 per cent., rickets and encrocephalitis; in 6 per cent., prolonged labor.

In the idiocies of the first class there is sometimes a premature ossification of the cranial bones. This fact, I believe, is well established. The idea that this premature ossification of the cranial bones compresses the brain and prevents its development is entirely untenable, nor has it ever been considered by myself to furnish the indication for the operation; still it is my opinion that this class—the microcephalic idiots without fits or palsies—furnishes the best field for the operation. It is among them that the largest number of improvements have been recorded. My own view of the *rationale* of the operation is that it has a profoundly disciplinary effect upon the idiot. These creatures are often not to be affected at all by ordinary educational methods; neither rewards nor punishments stimulate their effort or excite their attention. They cry, scream, and throw themselves about without the slightest reference to anything that is said to them or done for them. The parents, as a rule, abandon themselves to despair and yield all their attention simply to gratifying the morbid displays of the imbecile child. I have known a mother to carry an idiot child about on her arm the whole day, only putting it down for a short interval for her meals or while the child was sleeping. This she kept up for more than a year, and at the same time did her housework, cooked, and arranged her table and looked after all the requirements of the home. As soon as the child was placed on the floor or in its crib, it inevitably set up a horrible and persistent screaming, which no amount of severe words or rigorous punishment would affect. In other cases the idiots or imbeciles which are found in institutions suffer, perhaps, from too much discipline and not enough personal attention and the lifting influence of bright and healthy children about him or her.

The operation of craniotomy upon children in institutions attracts the attention of the nurses and of the medical officers, and the children get more care and more stimulating words and help in various directions. I would repeat, therefore, that it is in my opinion largely through its pedagogic influence that an improvement in these cases takes place, and that the operation is allied in its effect to a severe piece of castigation. In the very low types of criminals it is a well-recognized fact by philanthropists that discipline and systematic work can only be obtained by actual corporeal punishment in many instances, for nothing else seems actually to appeal to them. In the very lowest grades of intelligence, such as we find in idiots and imbeciles, it is probable that only these very powerful inhibitory influences, such as

accompany the performance of a capital operation, can affect materially the intellect of the child. It is through some such explanation as this that I would explain the fact that a second operation on these children is attended by further good results, and that sometimes the second operation is absolutely necessary before any result is obtained at all.

In addition to this educational or pedagogic effect on idiots, it is not impossible to suppose that by removing certain parts of the skull-cap we do allow for a freer expansion of the brain, that its circulatory supply may be improved and the tendency to growth and development of nerve-centres receive something of a stimulus.

Among fourteen improved cases (later operations) the average age was three and one-third years, and the range of age was nine months to six years.

Microcephalus and idiocy occurred in all, epilepsy in 4, paralysis (diplegia) in 3.

Indications for Operation.

While I feel that it is still too early to indicate exactly what cases should be operated upon, yet I think that we can lay down some rules with much more confidence than could have been done a few years ago.

1. As to the question of age. It is undoubtedly the fact that very little hope can be expected after a child has reached the age of four or five years, and the best chances for improvement will be obtained if the operation is done under the age of four. Dr. Mies (*Ueber das Hirngewicht des heranwachsenden Menschen*) has shown that the development of the brain is divided into three equal periods. The brain increases in weight by one-third during the first three months of life. It increases in weight another third during the period from the tenth month to about the middle of the third year. The last third increment takes place during the period between two and a half years and adult life, and most of this last increment takes place before the child has reached the age of seven years. It is in the second third of the brain development or the early part of the last third that most improvement is recorded from craniotomy. At the same time there have been some striking successes, so far as symptoms are concerned, in children as old as nine or eleven years, but these are cases in which there have been epilepsy or paralysis or some other motor disturbance. The simple forms of idiocy with microcephalus are certainly not benefited unless operated upon early in life.

2. As to the types of cases in which operation is indicated. As I have already stated, the operation so far shows that it is in the simple forms of idiocy with a moderate amount of microcephalus that most improvement is to be expected. Children who have birth-palsy and decided double paraplegia, and children who have a hemiplegia with epilepsy

dependent on some extravasation of blood and large sclerotic focus in the brain, are rarely helped. It has, however, occurred that even in this latter class of cases improvement has been brought about so far as the epileptic attacks are concerned.

3. Before operating or selecting a patient for operation, the question of cretinism should be carefully considered. If the child is a cretin, that is to say, if the idiocy is due to myxœdema following upon the absence of the thyroid gland, then no operation should be for a moment considered, but the child should be fed upon thyroid extract.

4. The question of hereditary syphilis should be carefully considered, particularly in the first months or year of life, and if there are decided indications of syphilitic exudation or of destructive changes in the brain, vigorous mercurial treatment should be attempted before anything else is undertaken. The idiocy due to a hereditary syphilis, meningitis, or meningo-encephalitis is not likely to be helped by operation if medical therapeutics fail.

5. A good many idiotic children have manifest signs of rickets or tuberculosis. In the case of rickets the operation is not necessarily counterindicated, but the child should receive proper nourishment and medical care before it is attempted. In distinctly tubercular children it would be folly to attempt any surgical interference.

6. As to the question of microcephalus, there seems to be a very great difference in the standard accepted by observers as to what is microcephalus. There is generally a rather small head in these cases of idiocy, but distinct microcephalus is rare. When it exists I doubt if operation does any good, because here there is usually very great lack of brain development. I therefore append to this paper some tables containing measurements of my own, as well as figures collected by Dr. H. D. Chapin, showing the average circumference of the head of the infant or young child at different ages.

Table of normal brain measurements based for first two years on measurements of 98 children, by Dr. H. D. Chapin; last two years on author's measurements. The figures are higher than those given by Lihazik, who makes the great circumference at end of twenty-first month 46 cm., but the above figures are based on measurements of the unshaven scalp. A deduction of 1 cm. for the hair brings it about to German measurements.

	Birth.	5th to 6th month.	11th mo. to 1 year.	18 months to 2 years.	3d year.	4th year.
Great circumference,	34.72	38.94	44.91	47.41 (Idiots, 46.3)	49.0 (Idiots, 47.2)	49.5 (Idiots, 47.2)
Naso-occipital arc,	22.33	26.05	30.41	32.83		
Naso-bregmatic arc,	9.22	9.83	12.14	13.16		
Bregmato-lambdoid arc,	8.94	10.16	11 33	11.41		

SUMMARY. Those who have read the foregoing will see that I hold the operation of craniotomy for idiocy to be still justifiable in a certain selected class of cases. I show that by perfected methods of operating the danger to life is under 5 per cent., and will probably become still less. The clinical reports quoted show improvement after operation too often for the facts to be ignored, even allowing for the happy therapeutic temperament of the operating surgeon; and in my personal experience one-half of the recovered cases have been improved.

The method by which improvement is brought about is largely a surgico-pedagogic one. All those who have had experience in educating idiots lay stress on the importance of special pedigogics, and craniotomy belongs, in a measure, to this class of therapeutic procedure. It may have some additional value by stimulating the circulation and nutritional activity of the brain.

The cases in which the operation is indicated are generally those of cerebral agenesis, rather than those having extensive sclerotic lesions and palsies. The operation may sometimes be repeated with benefit; and the results are not always immediate, especially so far as the cessation of the fits is concerned.

50 W. FORTY-SIXTH ST., NEW YORK.

THE INFLUENCE OF ALCOHOL AND ALCOHOLIC DRINKS UPON THE CHEMICAL PROCESSES OF DIGESTION.[1]

BY R. H. CHITTENDEN, PH.D.,
PROFESSOR OF PHYSIOLOGICAL CHEMISTRY IN YALE UNIVERSITY,

AND

LAFAYETTE B. MENDEL, PH.D.,
INSTRUCTOR IN PHYSIOLOGICAL CHEMISTRY.

IN considering the influence of alcohol and alcoholic drinks upon digestion we must have, at the outset, a clear understanding of what is meant by or included under the term digestion. Primarily, the object of digestion is to convert the insoluble and non-diffusible foodstuffs into forms capable of being absorbed. This is accomplished mainly through the agency of certain ferments or enzymes contained in the several digestive fluids, viz., the saliva, gastric juice, and pancreatic juice. The first of these fluids, secreted by three pairs of glands (salivary glands) which pour their secretions into the mouth, acts solely on starchy, farinaceous, or carbohydrate foods, transforming them into soluble dextrins

[1] A report presented to the "Committee of Fifty for the Investigation of the Liquor Problem," at a meeting held in New York, May 3, 1895.

and sugar—a process which commences in the mouth and continues for a short time in the stomach until the ferment of the saliva is finally destroyed by the increasing acidity of the gastric juice. The gastric juice, on the other hand, secreted by the tiny cells lining or composing the mucous membrane of the stomach, acts solely upon the proteid or albuminous foods, transforming them into a number of products characterized especially by their solubility and diffusibility. When the acid chyme leaves the stomach it passes through the pylorus into the small intestine, where it is exposed to the double action of the bile and pancreatic juice, the latter a powerful digestive fluid containing three distinct ferments. One of these ferments, an amylolytic enzyme, is apparently identical with the ferment of the saliva, and, like the latter, converts any unchanged starch into soluble dextrins and sugar. The second ferment is a powerful proteolytic enzyme called trypsin, which, in a neutral or alkaline solution, changes proteid matter into a row of soluble and diffusible products somewhat different in nature from those formed in acid gastric digestion. The third ferment is an adipolytic or fat-splitting ferment, which apparently transforms at least a portion of the fats of the food into soluble forms. This threefold action of the pancreatic juice may continue for some time in the small intestine, but as the peristaltic or wave-like contraction of the intestinal walls tends to push the contents of the tube onward toward the large intestine, and as absorption is quite rapid at this point, the conditions gradually become unfavorable for digestive action. The fluid and soluble matter is gradually absorbed into the blood and chyle, the contents of the intestine thereby becoming more or less viscous and compact, while the onset of fermentative and putrefactive changes gives rise to an acid reaction, all of which is inimical to the continuation of pancreatic digestion.

This briefly represents, in a general way, the character of the changes induced by the several digestive juices—chemical changes in the character of the various foodstuffs induced by the several digestive ferments or enzymes, and which are absolutely essential for the advantageous utilization of the food by the body. It is quite evident, however, that the rate and extent of digestion may be modified by a variety of circumstances, and these are by no means limited to the action of the respective ferments or enzymes. Thus, the process of secretion in a given set of glands may be so modified that the yield of digestive fluid is greatly reduced, thus diminishing the amount of fluid available for digestion; or the secretion may be so modified in composition that it is less adapted for carrying out its normal function. On the other hand, there may be an increased secretion of the digestive fluid by which digestion is accelerated through the mere increase in volume of the active fluid, or the strength of the secretion may be increased, thus leading to more vigorous digestive action. Such changes may be induced by an influence exerted through

the nervous system, for, as is well known, secretion is more or less controlled, both as regards the quantity and composition of the fluid, by certain nerve-fibres; and thus an agent may have an important influence upon digestion through its influence upon certain parts of the nervous system, by which the activity of the secreting gland is controlled and modified, and this quite independent of any specific action the agent may exert, by its mere presence, upon the chemical or solvent action of the secretion or its contained ferment.

Again, as is well known, excessive accumulation of the products of digestion tends to retard or even check the rate of digestion through an inhibitory influence upon the activity of the ferment, hence modifications in the rate of absorption have a direct influence upon the digestive process. Consequently, an agent which by its mere presence in the stomach-contents, for example, is without direct action on the ferment, or even without influence when absorbed into the blood on the process of secretion, may indirectly influence digestion by either retarding or accelerating absorption. Further, the mechanical movements of the gastro-intestinal tube, *i. e.*, peristalsis, have their influence upon digestion, solution of the proteid foods especially being facilitated by the vigorous churning to which the contents of the stomach and intestine are subjected under normal circumstances. The onward movement of the contents of the alimentary tract is likewise governed by the proper contraction of the longitudinal and circular muscle-fibres of the intestine, and as all of these muscles, both of the stomach and intestine, are controlled by the nervous system, it follows that digestion may be somewhat modified through this channel, indirectly to be sure, but to quite an appreciable extent. Hence certain agents, acting primarily upon the nervous system, may indirectly in this manner have an influence upon digestion without showing any special action upon the digestive enzymes, or upon the process of secretion or absorption.

From these brief statements it is evident that what we term digestion is a complicated chemico-physiological process involving not only the simple solvent or digestive action of the several digestive juices, or of their contained ferments or enzymes, but dependent in no small degree for its successful working upon the kindred processes of secretion, absorption, etc. Hence, in attempting any accurate and complete study of the influence of alcohol and alcoholic fluids upon digestion, there must be a clear recognition of the fact that no single line of experimentation can lead to full and concise results covering the whole ground of inquiry. For experimental purposes, therefore, the subject must be studied under several distinct heads, as (1) the influence of alcohol and alcoholic drinks upon the process of secretion; (2) upon the process of absorption; (3) upon peristalsis; and (4) upon the purely chemical processes of digestion. It is the latter phase of the subject which has been our study

during the past year, and the report which we now offer covers simply the influence of alcohol and a variety of alcoholic drinks upon the digestive action of the several digestive fluids and their contained ferments or enzymes. Such a study cannot properly be carried out on animals nor on human beings, since it would then be almost impossible to connect the results obtained with their true cause. We must at first exclude all of the accessory influences connected with secretion, absorption, and peristalsis if we are to learn the influence of alcoholic drinks upon digestive action, and this is best done by artificial digestive experiments in which saliva, gastric juice, and pancreatic juice are allowed to act under definite and constant conditions upon the several foodstuffs, and any variations in activity carefully determined. In this way, and in this way only, in our opinion, is it possible to measure the exact influence of alcohol and alcoholic fluids upon digestive action; *i. e.*, upon the purely chemical processes of digestion.

Before proceeding further, we would call attention to the fact that in writing this report we have confined ourselves mainly to a mere statement of the results obtained in our work, with the obvious conclusions to be drawn therefrom. In only a few instances have we attempted any comparison with the results obtained by other workers in this direction, and, as a rule, we have refrained from generalizations other than those plainly warranted by the data which we ourselves have obtained. At the end of our report we have appended a short bibliography giving the more important papers by previous workers.

Gastric Digestion (*i. e.*, Proteolysis by Pepsin-hydrochloric Acid).

The solvent action of the gastric juice on proteid or albuminous foods is due solely to the presence of pepsin-hydrochloric acid, but the amount of both pepsin and acid in the natural secretion varies considerably with different states of the system. The average amount of hydrochloric acid, however, is approximately 0.2 per cent, while to the pepsin no definite figure can be given, since as yet the chemist has not been able to isolate the ferment in a pure state. Further, it is quite certain that both ferment and acid are subject to great variation in the amount present in the secretion at different stages of digestion and under different conditions of health and nutrition. In view of these facts we have experimented under varying conditions in order that our results may have as wide an application as possible.

The methods pursued were as follows:

(*a*) *With fluid egg-albumin.*[1] The albumin solution was prepared

[1] See R. H. Chittenden: "Observations on the Digestive Ferments;" Medical News, Philadelphia, February 16, 1889.

after the method recommended by Schütz.[1] A quantity of undiluted white of egg was freed from globulin by the addition of hydrochloric acid of specific gravity 1.12 (4.2 c.c. acid to 300 c.c. of albumin), the mixture shaken vigorously, and after standing some hours filtered through paper. The clear acid fluid was then made exactly neutral with dilute sodium carbonate, after which it is ready for use. Ten c.c. of this fluid contain a little less than 1 gram of coagulable proteid, the exact amount being determined by heat-precipitation, collecting the coagulum on a weighed filter and drying at 110° C.

The digestive experiments were made in series, each individual mixture containing the same volume of the prepared albumin solution (10–20 c.c.), together with the same amount of pepsin and acid. The albumin solution was introduced into a small flask of 200 c.c. capacity provided with a suitable stopper, water and alcohol or alcoholic fluid being added to make the volume up to 50 c.c.

Lastly, 50 c.c. of 0.4 per cent. hydrochloric acid, containing a known amount of pepsin, were added, making the total volume of each mixture 100 c.c., and the strength of acid 0.2 per cent. HCl. It is thus evident that the only variable element in the mixtures of a given series is the amount of alcohol or alcoholic fluid present. The flasks were then placed in a water-bath, kept approximately at the body temperature (38–40° C.) for a definite period—usually five to seven hours. At the end of the allotted time, the extent of digestive action was determined by simply heating the mixtures to boiling, neutralizing the acid fluid by addition of an equivalent amount of sodium carbonate in a 1 per cent. solution, and collecting the precipitate of unaltered albumin or acid-albumin on a weighed filter, washing it with boiling water until free from chlorides, and then drying at 110° C. until of constant weight. The difference between the weight of coagulable albumin introduced and the amount found at the end of the experiment gives the amount of soluble digestive products, *i. e.*, albumoses and peptones, formed under the conditions of the experiment. In this way it is possible to measure accurately the extent of proteolytic action under varying conditions.

(*b*) *With coagulated blood-fibrin.* Fresh blood-fibrin from the blood of oxen or sheep was washed with water until quite white, then boiled repeatedly with water, after which it was thoroughly extracted with cold alcohol, boiling alcohol, and, lastly, with ether. It was then ground to a coarse powder and passed through a sieve, so constructed that the particles collected were all approximately of the same size. The so-prepared powder was then dried at 110° C. until of constant weight.

The digestive experiments with this form of proteid matter were conducted as follows: A definite amount of alcohol or alcoholic fluid was

[1] Zeitschr. f. physiol. Chem., Band ix, p. 581.

introduced into each flask, water being added to make the volume 50 c.c. Then 50 c.c. of 0.4 per cent. hydrochloric acid containing a known amount of pepsin were added, thus making the total volume of fluid 100 c.c. To this mixture two grams of the prepared fibrin were added. Thus, as in the experiments with fluid egg-albumin, all of the mixtures of a given series were exactly alike in containing the same volume of 0.2 per cent. hydrochloric acid, the same amount of pepsin, etc., but unlike in the percentage of alcohol or alcoholic fluid present. For comparison, one mixture of each series contained no alcohol whatever. When prepared, the mixtures of a given series were placed in a bath at 38°–40° C. for two to three hours, where they were kept under exactly the same conditions, being stirred or shaken to the same extent, etc. At the end of the given period the mixtures were heated to boiling to destroy the ferment, after which the undigested residue was collected on a weighed filter, washed with boiling water until free from all soluble matter, then dried at 110° C. until of constant weight. The difference between the weight of the fibrin taken and the undissolved residue is a true measure of the digestive action under the conditions of the experiment.

Action of Absolute Alcohol (99.5–100 per cent.).

The percentages of alcohol referred to are percentages by volume unless otherwise specified. The pepsin employed was a very active scale pepsin marked 1 : 4000.

Experiment 1.

Conditions:

Proteid = fluid egg-albumin (20 c.c.).
20 c.c. albumin solution contain 1.6398 grams dry albumin.
0.03 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion $6\frac{1}{12}$ hours at 38°–40° C.

Alcohol.	Undigested albumin.	Proteid digested.	Relative proteolytic action.[1]
0 per cent.	0.1850 gram.	88.8 per cent.	100.0
6 "	0.2708 "	83.5 "	94.0
12 "	0.5473 "	66.7 "	76.0
18 "	0.6703 "	59.2 "	66.6

Experiment 2.

Conditions:

Proteid = fluid egg-albumin (15 c.c.).
15 c.c. albumin solution contain 1.0522 grams dry albumin.
0.0024 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion $5\frac{1}{3}$ hours at 38°–40° C.

[1] Expressing the relative extent of digestive action as compared with the action of the control-experiment, the latter being taken as 100.

Alcohol.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.4007 gram.	62.0 per cent.	100.0
1 "	0.4075 "	61.3 "	98.8
3 "	0.5146 "	51.1 "	82.4
6 "	0.6256 "	40.6 "	65.4

Experiment 3.

Conditions:

Proteid = fluid egg-albumin (10 c.c.).
10 c.c. albumin solution contain 0.8199 gram dry albumin.
0.03 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 5⅛ hours at 38°–40° C.

Alcohol.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	trace	100.0 per cent.	100.0
1 "	0.0100 gram.	98.8 "	98.8
3 "	0.0130 "	98.5 "	98.5
5 "	0.0250 "	97.0 "	97.0
8 "	0.0699 "	91.5 "	91.5
10 "	0.0875 "	89.4 "	89.4

Experiment 4.

Conditions:

Proteid = fluid egg-albumin (20 c.c.).
20 c.c. albumin solution contain 1.9198 grams dry albumin.
0.05 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 5½ hours at 38°–40° C.

Alcohol.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.0887 gram.	95.4 per cent.	100.0
1 "	0.0740 "	96.1 "	100.8
5 "	0.2617 "	86.4 "	90.5
10 "	0.5373 "	72.0 "	75.5
15 "	0.5859 "	69.5 "	72.8

Experiment 5.

Conditions:

Proteid = blood-fibrin (2 grams).
0.016 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 2¼ hours at 38°–40° C.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.5834 gram.	70.9 per cent.	100.0
1 "	0.5727 "	71 4 "	100.7
3 "	0.6273 "	68 7 "	96.8
5 "	0.6493 "	67 6 "	95 3

The following five series of experiments were all made after the same plan, each mixture containing 2 grams of blood-fibrin, 0.016 gram pepsin in 0.2 per cent. hydrochloric acid, and warmed at 38°–40° C. for 2¼ hours:

Experiment 6.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3676 gram.	81.7 per cent.	100.0
10 "	0.5970[1] "	70.2 "	85.9

Experiment 7.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.2013 gram.	90.0 per cent.	100.0
5 "	0.2601 "	87.0 "	96.6

Experiment 8.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.1759 gram.	91.3 per cent.	100.0
5 "	0.2145 "	89.3 "	97.8

Experiment 9.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.2027 gram.	89.9 per cent.	100.0
5 "	0.2619 "	87.0 "	96.7

Experiment 10.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3881 gram.	80.6 per cent.	100.0
4 "	0.4118 "	79.5 "	98.6

In the following three experiments the conditions were the same as in the preceding, excepting that the mixtures were warmed at 38°–40° C. for 2 hours instead of 2¼ hours:

Experiment 11.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.5315 gram.	73.5 per cent.	100.0
2 "	0.5390 "	73.1 "	99.4

Experiment 12.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.4630 gram.	76.9 per cent.	100.0
2 "	0.4583 "	77.1 "	100.2

Experiment 13.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.1970 gram.	90.2 per cent.	100.0
5 "	0.2830 "	85.9 "	95.2

[1] Filtered very slowly and could not be washed thoroughly, hence the result is only approximately correct.

In the following three experiments the conditions were the same as in the preceding, except that the mixtures were warmed at 38°–40° C. for 1¼ hours:

Experiment 14.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.5068 gram.	74.7 per cent.	100.0
2 "	0.4970 "	75.2 "	100.6

Experiment 15.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.2032 gram.	89.9 per cent.	100.0
5 "	0.2317 "	88.5 "	98.4

Experiment 16.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3247 gram.	83 8 per cent.	100.0
5 "	0.3554 "	82.3 "	98.2

In the following two experiments the mixtures were warmed at 38°–40° C. for 1½ hours:

Experiment 17.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3361 gram.	83.2 per cent.	100.0
5 "	0.4040 "	79.8 "	95.9

Experiment 18.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3867 gram.	80.7 per cent.	100 0
5 "	0.4352 "	78.3 "	97.0

In the following experiment the conditions were apparently much the same as in the preceding experiments, although the results show a greater degree of retardation with like percentages of alcohol:

Experiment 19.

Conditions:

Proteid = blood-fibrin (2 grams).
0.02 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 2¼ hours at 38°–40° C.

Alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.4536 gram.	77.32 per cent.	100.0
0.5 "	0.4688 "	76.56 "	99.0
1.0 "	0.4954 "	75.23 "	97.2
2.0 "	0.4958 "	75.21 "	97.2
3.0 "	0.5324 "	73.38 "	94.9
5.0 "	0.6031 "	69.84 "	90.3

A careful study of all of the preceding results makes it evident that we cannot define with mathematical exactness the action of a given percentage of absolute alcohol on pepsin-proteolysis, since variations in the attendant conditions, *i. e.*, the relative amounts of pepsin, acid, and proteid, together with the period of digestion, the digestibility of the particular proteid, etc., are prone to modify the final result. Thus, with a weak gastric juice, where the amount of ferment present is small and digestive action consequently slow, or where the proteid material used is difficult of digestion, the retarding effect of a given percentage of alcohol is far greater than when the digestive fluid is more active; that is, when it contains more pepsin. (Contrast Experiments 1, 2, and 3.) Further, this difference of action is more pronounced the larger the percentage of alcohol present. Thus, in Experiments 2 and 3, where the difference in the amount of pepsin present is very great, the action of 1 per cent. of absolute alcohol is essentially the same; but when the amount of alcohol is raised to 3, 5, or 6 per cent. then the difference in digestive action is very striking.

Bearing in mind the possibility of these variations incidental to variations in the attendant conditions, and recognizing the possibility and probability of just such variations in the human stomach, we may look at our results with a view to drawing some general conclusions. First, it is plainly manifest that in the presence of small amounts of alcohol (1–2 per cent. of absolute alcohol) gastric digestion may proceed as well or even better than under normal circumstances. In fact, many of our experiments show a slight increase in digestive power when the mixture contains 1 or 2 per cent. of absolute alcohol. This increased digestive action, though slight, occurs too frequently to be the result of mere accident, and apparently indicates a tendency for alcohol, when present in small quantity, to increase slightly the digestive action of pepsin-hydrochloric acid; or, in other words, to so stimulate the ferment that it can accomplish somewhat more, under given conditions, than it otherwise could do. As the percentage of alcohol is raised, retardation or inhibition becomes more noticeable, although ordinarily it is not very pronounced until the digestive mixture contains 5–10 per cent. or more of absolute alcohol. With 15–18 per cent. of absolute alcohol, digestive action may be reduced one quarter or even one-third, the exact amount of retardation, however, being especially dependent upon the strength or activity of the gastric juice and upon the natural digestibility of the proteid material. (See Experiments 1, 3, 4, and 6.) It is to be remembered, however, that 18 per cent. of absolute alcohol would be equivalent to 36 per cent. of proof-spirit, so that if we should assume the contents of a human stomach at a given period to be one-third proof-spirit, it might perhaps be considered that digestive action would be retarded to the extent of 25–35 per cent., provided the gastric juice present in the

stomach was of fair strength and the proteid matter of ordinary digestibility. Such percentages of proof-spirit, however, are not likely to be long present in the stomach, and it is perhaps idle to speculate on such hypothetical cases. We may in this connection, however, again emphasize the fact that the stronger the gastric juice and the more digestible the proteid food undergoing digestion the less retardation will a given percentage of alcohol produce, while, on the other hand, the weaker the gastric juice and the more indigestible the proteid the greater will be the inhibition caused by a given percentage of alcohol. In other words, those variations which must naturally exist in the stomach-contents of different individuals, both in health and disease, will lead to different degrees of retardation in the presence of given percentages of absolute alcohol. It would, therefore, be unwise to make a general specific statement regarding the action of a given percentage of alcohol. Under definite conditions, however, as our experiments plainly show, the presence of a definite amount of alcohol always leads to essentially the same results.

In order to prevent any misinterpretation of our results, we would again call attention to the fact that we are dealing here with only one of the four questions that need to be answered before we can hope to fully understand the influence of alcohol on gastric digestion as a whole. Thus, our results afford plain evidence of the influence of alcohol on the digestive or solvent power of the gastric juice, but we should not be justified in arguing that exactly the same results would follow from the introduction of alcohol into the living stomach. The action of a given percentage of alcohol on proteolysis alone would be essentially the same in the stomach as in a beaker, provided the alcohol was not absorbed into the blood and thus removed from contact with the digestive mixture, and provided it did not exert any influence on the character of the gastric juice secreted. But it is easily conceivable that a percentage of alcohol which does not interfere with solution of the proteid foodstuffs may so modify the amount or character of the secretion that digestion might be greatly stimulated or greatly retarded. Further, as already stated, the presence of alcohol in the stomach may so affect absorption and peristalsis that the rate of digestion may be modified from this cause; hence, the results above recorded are to be used only in drawing conclusions as to the effect of various percentages of alcohol on the purely chemical process of gastric digestion, *i. e.*, on pepsin-proteolysis.

With reference to these other questions which have such an important bearing on gastric digestion we must await the appearance of more complete experimental data for their solution, and not until then can we explain fully the action of alcohol on digestion in the broad sense indicated.

In conclusion, it is to be noted that our results are more or less in

accord with what has been previously published concerning the action of alcohol on gastric digestion. Thus, Bikfalvi[1] found in artificial digestive experiments that alcohol, even in small quantities, retards normal gastric digestion. Klikowicz[2] found that the presence of 5 per cent. of alcohol in the digestion of egg- and serum-albumin led to somewhat variable results, although, as a rule, there was an indication of a slight stimulation of proteolytic action. In the presence of 10 per cent. of alcohol there was always marked retardation, while 15, 20, and 30 per cent. of alcohol checked digestion to a marked degree.

Roberts found by artificial digestion-experiments that in the presence of less than 10 per cent. of proof-spirit there was no appreciable retardation. With 10 per cent. retardation was only barely detectable. With 20 per cent. there was quite distinct, but still only a slight, retardation. Above this point, however, the inhibitory effect of alcohol increased rapidly.[3]

That the action of a digestive ferment may be both stimulated and retarded by the same substance, according to the quantity present, has been already demonstrated;[4] hence there is no inconsistency in the above results with alcohol. The same action has likewise been observed with yeast-cells.[5]

ACTION OF WHISKEY.

Pure whiskey, as is well known, is simply "a diluted alcohol with a peculiar flavor or aroma, due to the raw material employed in its manufacture, and developed during the fermentation, distillation, and ageing of the liquor."[6]

Analysis of a large number of samples of whiskey made under the direction of the New York State Board of Health[7] has shown that adulteration is limited mainly to the addition of water and coloring matter, while such deleterious substances as fusel oils may be present in liquors which have not been properly rectified. Thus, the percentage of alcohol was found to vary from 28.9 per cent. by volume to 60.3 per cent. By far the larger number of samples analyzed showed a content of alcohol ranging from 35 to 40 per cent. by volume.

Our work on the influence of whiskey on gastric digestion was commenced by studying the influence of a medium quality of rye whiskey (Mount Vernon pure rye whiskey, $1 per quart), analysis of which gave the following results:

[1] Jahresbericht für Thierchemie, xv. p. 273. [2] Virchow's Archiv, Band 102, p. 376.
[3] Digestion and Diet, p. 132.
[4] Chittenden: Studies in Physiological Chemistry. Yale Univer. Vol. i. p. 76; also vol. 3, p. 60. Dubs: Virchow's Archiv, Band 134, pp. 519–540.
[5] Schultz: Pflüger's Archiv, Band 42, p. 517. Biernacki: Jahresbericht für Thierchemie, 17, p. 477.
[6] Second Annual Report of the New York State Board of Health, p. 642.
[7] Loc. cit., p. 647–648.

Specific gravity . . . . . 0.937 at 17.5° C.
Alcohol, by volume . . . . . 50–51 per cent.[1]
Solid residue at 110° C. . . . . 0.3284 gram per 100 c.c.
Ash . . . . . 0.0040 " " "
Reaction acid.

Experiment 20.

Conditions:

Proteid = fluid egg-albumin (10 c.c.).
10 c.c. albumin solutin contain 0.8146 gram dry albumin.
0.03 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 4½ hours at 38°–40° C.

Whiskey.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.0182 gram.	97.8 per cent.	100.0
3 "	0.0176 "	97.9 "	100.1
5 "	0.0288 "	96.6 "	98.7
8 "	0.0284 "	96.6 "	98.7
10 "	0.0384 "	95.3 "	97.4

Experiment 21.

Conditions:

Proteid = fluid egg-albumin (10 c.c.).
10 c.c. albumin solution contain 0.8146 gram dry albumin.
0.012 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 6 hours at 38°–40° C.

Whiskey.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.0270 gram.	96.7 per cent.	100.0
1 "	0.0231 "	97.2 "	100.5
3 "	0.0333 "	96.0 "	99.2
5 "	0.0395 "	95.2 "	98.4
8 "	0.0616 "	92.5 "	95.6
10 "	0.0774 "	90.5 "	93.5

Experiment 22.

Conditions:

Proteid = fluid egg-albumin (15 c.c.).
15 c.c. albumin solution contain 1.0522 grams dry albumin.
0.0024 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 5⅓ hours at 38°–40° C.

Whiskey.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.4007 gram.	62.0 per cent.	100.0
1 "	0.4263 "	59.5 "	95.9
3 "	0.4545 "	56.9 "	91.7
6 "	0.5372 "	49.0 "	79.0
Absolute alcohol.			
3 "	0.5146 "	51.1 "	82.4

[1] Varying somewhat in different samples.

Experiment 23.

Conditions:

Proteid = blood-fibrin (2 grams).
0.016 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 2⅝ hours at 38°–40° C.

Whiskey.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3401 gram.	83.0 per cent.	100.0
1 "	0.3357 "	83.3 "	100.3
3 "	0.3401 "	83.0 "	100.0
6 "	0.3678 "	81.7 "	98.4

Experiment 24.

Conditions the same as in the preceding experiment:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.2013 gram.	90.0 per cent.	100.0
5 " absol. alcoh.	0.2601 "	87.0 "	96.6
5 " whiskey	0.2312 "	88.5 "	98.3

In the following experiment six different samples of whiskey were employed, several of which were known to contain only 40 per cent. of alcohol, and their action contrasted with half the percentage of absolute alcohol:

Experiment 25.

Conditions:

Proteid = blood-fibrin (2 grams).
0.009 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 1$\frac{11}{12}$ hours at 38°–40° C.

Whiskey.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.6701 gram.	66.5 per cent.	100.0
20 "	0.9659 "	51.8 "	77.8
20 "	0.9849 "	50.8 "	76.3
20 "	1.0378 "	48.2 "	72.4
20 "	1.0156 "	49.3 "	74.1
20 "	1.0390 "	48 1 "	72.3
20 "	1.0735 "	46.4 "	69 7
Absolute alcohol.			
10 per cent.	1.0673 "	46.7 "	70.2

It is thus evident from these experiments that when digestive action is fairly vigorous, as in the presence of moderate amounts of pepsin (Experiments 20, 21, and 23), small percentages of whiskey have no retarding action whatever upon gastric digestion; indeed, there is even a slight suggestion of increased digestive action in the presence of 1–3 per cent. of whiskey, much the same as was observed in the experiments with absolute alcohol. In the presence of 20 per cent. of whiskey digestive activity may be reduced one-fourth. Further, the retardation

which is produced by larger percentages of whiskey is approximately equal to the retarding action caused by half these percentages of absolute alcohol. In other words, the results would seemingly point to the contained alcohol as the main cause of the inhibition produced by the whiskey. In Experiment 22 we again have evidence of the greater retarding effect of both whiskey and alcohol when the gastric juice is weak, owing to the presence of a small amount of pepsin.

In order to determine more definitely the exact cause of the inhibitory action of whiskey on gastric digestion the following experiments were tried:

Experiment 26.

Conditions:

Proteid = fluid egg-albumin (15 c.c.).
15 c.c. albumin solution contain 1.0522 grams dry albumin.
0.0024 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion $5\frac{3}{4}$ hours at 38°–40° C.

Whiskey.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.5065 gram.	51.9 per cent.	100.0
1 "	0.5268 "	50.0 "	96.3
3 "	0.5496 "	47.8 "	92.1
6 "	0.6069 "	42.4 "	81.6
Whiskey residue.[1]			
1 per cent.	0.5105 "	51.5 "	99.2
6 "	0.4719 "	55.2 "	106.3

Experiment 27.

Conditions the same as in Experiment 25, except that the 15 c.c. of albumin solution contained 1.2219 grams of dry albumin, and the period of digestion was $4\frac{1}{12}$ hours:

Whiskey.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.5552 gram.	54.6 per cent.	100.0
1 "	0.6239 "	49.0 "	89.7
3 "	0.6573 "	46.2 "	84.6
6 "	0.6883 "	43.7 "	80.0
9 "	0.7457 "	39.0 "	71.4
Whiskey residue.			
1 per cent.	0.5559 "	54.6 "	100.0
6 "	0.5705 "	53.4 "	97.8

Experiment 28.

Conditions:

Proteid = blood-fibrin (2 grams).
0.016 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion $2\frac{1}{4}$ hours at 38°–40° C.

[1] The whiskey residue was prepared by simply concentrating a definite volume of whiskey on the water-bath until the alcohol and volatile matter were driven off, then making the residue up to the original volume with water. Hence, 1 per cent. residue means the residue contained in 1 per cent. of whiskey.

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.1759 gram.	91.3 per cent.	100.0
5 " absol. alcoh.	0.2145 "	89.3 "	97.8
5 " whiskey residue	0.1847 "	90.8 "	99.4

Experiment 29.

Conditions the same as in the preceding experiment, except that the period of digestion was $1\frac{3}{4}$ hours:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.2032 gram.	89.9 per cent.	100.0
5 " alcohol	0.2317 "	88.5 "	98.4
10 " whiskey	0.2181 "	89.1 "	99.1
10 " " distil.[1]	0.2499 "	87.6 "	97.4
10 " " residue	0.2002 "	90.0 "	100.1

Experiment 30.

Conditions the same as in the preceding experiment, except that the period of digestion was 2 hours:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.1970 gram.	90.2 per cent.	100.0
5 " alcohol	0.2830 "	85.9 "	95.2
10 " whiskey	0.3056 "	84.8 "	94.0
10 " " distil.	0.2336 "	88.4 "	98.0
10 " " residue	0.2027 "	89.9 "	99.6

Experiment 31.

Conditions the same as in the preceding experiment, except that the period of digestion was $1\frac{5}{12}$ hours:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3867 gram.	80.7 per cent.	100.0
5 " absol. alcoh.	0.4352 "	78.3 "	97.0
10 " whiskey	0.4481 "	77.6 "	96.1
10 " " distil.	0.4274 "	78.7 "	97.5
10 " " residue dissolved in water	0.4968 "	75.2 "	93.1
10 per cent. residue dissolved in alcohol[2]	0.3604 "	82.0 "	101.6

If the detailed results obtained in these many experiments are carfully scrutinized it will be seen that the small amount of solid matter

[1] The "whiskey distillate" was prepared by distilling a definite volume of whiskey nearly to dryness and making the distillate up to the original volume with water, the 10 per cent. whiskey distillate, therefore, meaning the volatile matter contained in that specific volume of whiskey.

[2] The whiskey residue obtained as already described, but dissolved in alcohol of the strength originally present in the whiskey instead of in water.

contained in whiskey—the so-called whiskey residue—has in the majority of cases little or no retarding action on gastric digestion. That there should be some variation is to be expected, owing to possible variations in the amount and character of this solid matter. Further, the residue obtained by evaporation of whiskey is not always completely soluble in water, and the action of this material may naturally be somewhat different when mixed with water than when dissolved in alcohol (see Experiment 31). Still the general conclusion seems to be warranted that, as a rule, the solid matter of the whiskey is not responsible for the retarding action of this fluid upon the chemical process of gastric digestion. Such action as the whiskey possesses is to be attributed mainly to the alcohol or other volatile matter it contains. At the same time it is to be noted that with a fairly active gastric juice (Experiments 29, 30, and 31), the amount of retardation even with 10 per cent. of whiskey is not great, any more than it is in the presence of 5 per cent. of absolute alcohol. When, however, the gastric juice is very weak from scarcity of the active ferment, as in Experiments 26 and 27, then even small amounts of whiskey exercise a very marked retarding effect upon the digestive process. Further, these two experiments plainly show that the retardation in these cases is due essentially to the volatile matter of the whiskey, and not to the solid matter contained in it. We may thus conclude, with Roberts,[1] that taking into account the quantity of whiskey commonly used dietetically with meals, the amount so consumed is not sufficient to appreciably retard the speed of gastric digestion. For, if the digesting mass in the stomach be estimated at 2 pounds, a wineglass (2 ounces) of whiskey added thereto would only equal 5 per cent. of proof-spirit (or 2.5 per cent. of absolute alcohol), an amount too small to hamper digestion to any appreciable extent. Even double such an amount, as Roberts says, would scarcely have any marked retarding effect upon pepsin-proteolysis. Hence, whiskey can be considered to impede the solvent action of the gastric juice only when taken immoderately and in intoxicating quantities.

So much has been said and written about the widespread adulteration and falsification of whiskeys that we deemed it wise before leaving the subject to make a search for samples of this liquor which would show a wide variation from what might be called the normal standard. The results thus far reported were obtained with whiskeys containing 50 per cent. of alcohol by volume. Prof. James Babcock, in his first and second annual report as assayer of liquors to the commonwealth of Massachusetts, gives the strength of 257 samples of ordinary whiskey analyzed by him as varying from 30 to 59 per cent. of alcohol by volume. The few samples that we have purchased in New Haven and analyzed, however, have, with one or two exceptions, shown very little difference in their

[1] Digestion and Diet, p. 133.

content of alcohol, although we took particular pains to obtain them from representative places. The character of these places may be indicated by their names.

		Alcohol.
Sample A,	from high-class grocer	50 per cent.
" B,	" Canadian Club whiskey	42 "
" C,	" saloon of better class	40 "
" D,	" " of low order	44 "
" E,	" " of low order	43 "
" F,	" " known as the "dead-house"	42 "
" G,	" " known as "Sneezer's"	40 "
" H,	" " quite respectable	40 "
" I,	" " McGraw's	30 "

With the exception of the first and last of these few samples there is very little variation in the content of alcohol. Digestion experiments tried with some of these whiskies gave the following results:

Experiment 32.

Conditions:

Proteid = blood-fibrin (2 grams).
0.015 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 1½ hours at 38°–40° C.

Whiskey.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.6131 gram.	69.4 per cent.	100.0
Sample I, 10 "	0.6591 "	67.1 "	96.6
" B, 10 "	0.6876 "	65.7 "	94.6
" G, 10 "	0.7469 "	62.7 "	90.3

Experiment 33.

Conditions practically the same as in the preceding experiment:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.5945 gram.	70.3 per cent.	100.0
Whiskey D, 10 "	0.7711 "	64.5 "	91.7
" C, 10 "	0.7352 "	63.3 "	90.0
" F, 10 "	0.7609 "	62.0 "	88.1
" E, 10 "	0.8086 "	59.6 "	84.7
" H, 10 "	0.8659 "	56 8 "	80.7
Absol. alcoh. 5 "	0.8362 "	58.2 "	82.7

If we compare the action of these samples of whiskeys, we see (Experiment 32) that sample I, with the lowest content of alcohol, has the least inhibitory effect. On the other hand, in Experiment 33 there are greater differences in the retardation produced by these several varieties of whiskey than one would expect from the slight variations in the content of alcohol. This, however, we are inclined to attribute, in part at least, to the presence of variable amounts of tannin. In accordance with this idea, we found that among those samples with a like content

of alcohol the presence of tannin was more conspicuous in the whiskeys with the greatest retarding action.

Action of So-called Fusel Oils on Gastric Digestion.

So much has been written concerning the contamination of whiskeys and other liquors with fusel oil that we deemed it wise to give some thought to this matter in connection with our study of the influence of whiskey, brandy, and other liquors on the chemical processes of gastric digestion. It is a well-known fact that when fermented saccharine liquors are submitted to distillation there are obtained, in addition to water and ordinary or ethyl alcohol, small quantities of other alcohols, which are commonly known as fusel oil. Each raw material used in the preparation of a distilled liquor is supposed to have its own particular form of fusel oil. Hence, there is the potato fusel oil, sugar-beet fusel oil, rye fusel oil, corn fusel oil, grape fusel oil, etc., which contain in various proportions propyl, butyl, amyl alcohol, etc. Of these alcohols, amyl alcohol is said to be the most poisonous, and it is generally understood to be present in largest quantity in the whiskeys made from the potato. However this may be, the various constituents of these fusel oils react upon each other during the process of ageing, forming new and more volatile combinations which help give to the respective fluids their aroma and bouquet. Hence, in old whiskeys fusel oils should be entirely absent, and in all properly distilled and rectified spirits the amount of these substances should be at the most quite small. Indeed, so far as our own experience goes, we have never found more than traces of these so-called oils in the whiskeys or brandies that we have examined. But with a view to ascertaining the effect of such substances on gastric digestion, assuming them to be present in whiskeys and other like liquors, we have tried some experiments with the alcohols of this class, in order to ascertain how their possible presence would influence the chemical processes of digestion. The results may be briefly detailed in the following experiments:[1]

Experiment 34.

Conditions:

Proteid = blood-fibrin (2 grams).
0.02 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 2 hours at 38°–40° C.

Amyl alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.5665 gram.	71 6 per cent.	100.0
0.10 "	0.5316 "	73.4 "	102.4
0.25 "	0.6176 "	69.1 "	96.4
0.50 "	0.6179 "	69.1 "	96.4
1.00 "	0.6887 "	65.5 "	91.4
2.00 "	0.8801 "	55.9 "	78.1

[1] These experiments were carried out in our laboratory by Richard F. Rand, Ph.B.

Experiment 35.

Conditions the same as in the preceding experiments, except that the period of digestion was $1\frac{5}{6}$ hours:

Isobutyl alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.7225 gram.	63 8 per cent.	100.0
0.05 "	0.6580 "	67.1 "	105.0
0.10 "	0.7583 "	62.0 "	97.1
0.25 "	0.7993 "	60.0 "	93.9
0.50 "	0.8313 "	58.4 "	91.4
2.00 "	0.8451 "	57.7 "	90.4

Experiment 36.

Conditions the same as in the preceding experiment:

Propyl alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.6136 gram.	69.3 per cent.	100.0
0.05 "	0.5514 "	72.4 "	104.4
0.10 "	0.5025 "	74.8 "	108.0
0.25 "	0.4944 "	75.2 "	108.5
0.50 "	0.5872 "	70.6 "	101.9
2.00 "	0.6192 "	69.0 "	99.5

Larger percentages of propyl alcohol gave the following results, the conditions being the same as in the preceding experiment, except that the period of digestion was $2\frac{1}{4}$ hours:

Propyl alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.5323 gram.	73.3 per cent.	100.0
5 "	0.7804 "	60.9 "	82 1
10 "	1.6271 "	18.6 "	24.0
15 "	1.8829 "	5.8 "	9 0
20 "	1.9047 "	4.7 "	6.4

Experiment 37.

Conditions the same as in the preceding experiments, save that the period of digestion was $2\frac{1}{4}$ hours:

Methyl alcohol.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.4892 gram.	75.5 per cent.	100.0
0.5 "	0.4492 "	77.5 "	102.6
2.0 "	0.4325 "	78.3 "	103.7
3 0 "	0.5381 "	73.0 "	96.7
5.0 "	0.5333 "	73.3 "	97.0

When it is remembered that these alcohols, if present at all, are found in whiskeys and similar liquors only in small quantities—hardly more than traces—it is seen that their action on the chemical processes of gastric digestion cannot be very deleterious. Indeed, so far as our

data show, the presence of traces of these alcohols tends to increase rather than to decrease the rate of digestive action. While they may be very undesirable impurities in alcoholic liquors, and may perhaps have many physiological properties detrimental to health, they certainly do not materially interfere with the chemical processes of gastric digestion. Physiologically, it is of interest to note how all of these alcohols, as well as ethyl alcohol, have the property of increasing the rate of digestive action when present in small amount. Also noticeable is the relationship between the position of the alcohol in the series and the extent of its stimulating and retarding action. Thus, methyl alcohol, the lowest member of the series increases the rate of proteolysis even when present to the extent of 2 per cent, while amyl alcohol produces stimulation only when present in amounts less than 0.2 per cent.

BRANDY.

According to Dr. Edward Smith, of England, "brandy is or should be the choicest and most agreeable member of the class of ardent spirits. It should be prepared by distillation from wine," but as is well known a large amount of the brandy consumed at the present time is simply alcohol distilled as in the preparation of whiskey, and flavored with oil of cognac. From this it may be inferred that brandy will have much the same action as whiskey on gastric digestion.

The brandy used in our first experiments was of good quality, known as Horne's cold distilled brandy, selling at $1.25 per quart. Analysis showed the following composition:

Specific gravity	0.940 (at 19° C.).
Alcohol by volume	47–48 per cent.
Solid residue at 110° C. . . .	0.0430 gram per 100 c.c.
Ash	0.0054 " " "
Reaction acid.	

Experiment 38.

Conditions:

Proteid = fluid egg-albumin (15 c.c.).
15 c c. albumin solution contain 1.3395 grams dry albumin.
0.006 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 7 hours at 38°–40° C.

Brandy.	Undigested albumin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3962 gram.	70.5 per cent.	100.0
1 "	0.4379 "	67.4 "	95.6
3 "	0.5012 "	62.8 "	89.0
6 "	0.5218 "	61.1 "	66.6
Brandy residue.			
1 per cent.	0.3992 "	70.2 "	99.4
6 "	0.3654 "	72.8 "	103.2

Experiment 39.

Conditions:

Proteid = blood-fibrin (2 grams).
0.016 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 2⅜ hours at 38°–40° C.

Brandy.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3401 gram.	83.0 per cent.	100.0
1 "	0.3306 "	83.5 "	100.6
3 "	0.3440 "	82.8 "	99.7
6 "	0.3433 "	82.9 "	99.8

Experiment 40.

Conditions the same as in the preceding experiment, except that the period of digestion was 2¼ hours:

Brandy.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.2013 gram.	90.0 per cent.	100.0
5 "	0.2251 "	88.8 "	98.7

Experiment 41.

Conditions the same as the above, except that the period of digestion was $1\frac{7}{12}$ hours:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3247 gram.	83.8 per cent.	100.0
5 " absol. alcoh.	0.3554 "	82.3 "	98.2
10 " brandy	0.3752 "	81.3 "	97.0
10 " " distil.	0.3489 "	82.6 "	98.5
10 " " residue[1]	0.3024 "	84.9 "	101.3

Experiment 42.

Conditions the same as the above, except that the period of digestion was 1½ hours:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3361 gram.	83.2 per cent.	100.0
5 " absol. alcoh.	0.4040 "	79.8 "	95.9
10 " brandy	0.4242 "	78.8 "	94.7
10 " " distil.	0.4286 "	78.6 "	94.4
10 " " residue in alcohol	0.4334 "	78.4 "	94.2
10 " " residue in water	0.3609 "	82.0 "	98.5

[1] Dissolved in water, being the residue from this percentage of brandy.

Experiment 43.

In this experiment four distinct samples of brandy were used.

Conditions:

Proteid = blood-fibrin (2 grams).
0.009 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 1½ hours at 38°–40° C.

Brandy.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.7941 gram.	60.3 per cent.	100.0
10 "	1.0007 "	50.0 "	82.9
10 "	0.9357 "	53.3 "	88.3
10 "	0.9304 "	53.5 "	88.7
10 "	0.9014 "	55.0 "	91.2

The experiments here recorded indicate that brandy has a slight retarding action on pepsin-proteolysis when present in quantities ranging from 5 to 10 per cent. When the gastric juice is relatively weak, then the retardation may be quite pronounced, as in Experiment 38. Such action as the brandy possesses is due almost wholly to the contained alcohol. Indeed, the solid matter present in brandy when separated and dissolved in water may even cause a slight increase in the rate of proteolysis. Evidently, we may draw the same conclusions regarding brandy that have been drawn in connection with whiskey. Both owe their action mainly to the contained alcohol; the results obtained with 10 per cent. of brandy being essentially the same as those obtained with 5 per cent. of absolute alcohol under like conditions.

RUM.

The only essential difference between whiskey and rum, as generally understood, is in the character of the aroma or flavor, and, as the volatile products which are the cause of the flavor are present only in very small quantity, it might be assumed that these two liquors would be very much alike in their general physiological action. The sample of rum (old St. Croix rum, at $1.25 per quart) with which our experiments were mainly made had the following composition:

Specific gravity . . . . . 0.935 (at 18.5° C.).
Alcohol by volume . . . . . 50.8–51.0 per cent.
Solid residue at 110° C. . . . . 0.3068 gram per 100 c.c.
Ash . . . . . 0.0070 " " "
Reaction acid.

Experiment 44.

Conditions:

Proteid = blood-fibrin (2 grams).
0.016 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion 2½ hours at 38°–40° C.

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.2013 gram.	90.0 per cent.	100.0
5 " rum	0.2304 "	88.5 "	98.3
5 " whiskey	0.2312 "	88.5 "	98.3
5 " absol. alcoh.	0.2601 "	87.0 "	96.6

Experiment 45.

Conditions the same as in the preceding experiment, except that the period of digestion was $1\frac{5}{8}$ hours:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.3995 gram.	80.1 per cent.	100.0
5 " absol. alcoh.	0.5392 "	73.1 "	91.2
10 " rum	0.5029 "	74.9 "	93.5
10 " " distillate	0.4561 "	77.2 "	96.3
10 " " residue in 50 pr. ct. alcoh.	0.4691 "	76.6 "	95.6
10 " rum residue in water	0.4290 "	78.6 "	98.1

Experiment 46.

Conditions the same as in the preceding experiment, except that the period of digestion was $2\frac{1}{4}$ hours:

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.1759 gram.	91.3 per cent.	100.0
5 " rum residue[1]	0.1589 "	92.1 "	100.8
5 " whiskey residue[2]	0.1847 "	90.8 "	99.4
5 " absolute alcohol	0.2145 "	89.3 "	97.8

The results plainly indicate that rum is essentially similar to whiskey in its action on artificial gastric digestion, and that such retardation as it causes is due mainly to the contained alcohol.

GIN.

Our experiments with this liquor were conducted solely with a sample of so-called "pure Holland gin," the composition of which was as follows:

Specific gravity	0.937 (at 16° C.).
Alcohol by volume	51.0 per cent.
Solid residue at 110° C. . . .	0.2968 gram per 100 c.c.
Ash	0.0090 " " "

Reaction very slightly acid.

Experiment 47.

Conditions:

Proteid = blood-fibrin (2 grams).
0.015 gram pepsin; 0.2 per cent. hydrochloric acid.
Period of digestion $1\frac{3}{4}$ hours at 38°–40° C.

[1] Residue dissolved in water. [2] Ibid.

Gin.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.4210 gram.	79.0 per cent.	100.0
1 "	0.4722 "	76.4 "	96.7
3 "	0.4681 "	76.6 "	96.9
5 "	0.4938 "	75.4 "	95.4
10 "	0.5725 "	71.4 "	90.3
Absolute alcohol.			
5 per cent.	0.5506 "	72 5 "	91.7

Experiment 48.

Conditions:

Proteid = blood-fibrin (2 grams).

0.008 gram pepsin; 0.2 per cent. hydrochloric acid.

Period of digestion 1¾ hours at 38°–40° C.

Fluid added.	Undigested fibrin.	Proteid digested.	Relative proteolytic action.
0 per cent.	0.9045 gram.	54.8 per cent.	100.0
10 " gin	1.0230 "	48.9 "	89.2
10 " " distillate	0.9961 "	50.2 "	91.4
10 " " residue[1]	0.9508 "	52.5 "	95.8
5 " absol. alcoh.	1.0104 "	49.5 "	90.3

[1] Dissolved in water.

The results plainly indicate an action on pepsin-proteolysis exactly analogous to that of the related fluids—whiskey, rum, and brandy. As in the case of the latter, such action as the gin possesses is to be ascribed solely to the contained alcohol; the action of 10 per cent. of gin, with its 50 per cent. of alcohol, being practically identical with that of 5 per cent. of absolute alcohol or 10 per cent. of proof-spirit.

(*To be continued.*)

REMARKS ON OPERATIONS ON THE GASSERIAN GANGLION, WITH A REPORT OF FIVE ADDITIONAL CASES.[1]

By W. W. Keen, M.D.,

PROFESSOR OF THE PRINCIPLES OF SURGERY AND OF CLINICAL SURGERY, JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.

On February 14, 1894, I reported to this Society, in conjunction with Dr. John K. Mitchell, a case of tic douloureux, in which I operated on the Gasserian ganglion. The patient, after the lapse of twenty-six months, has remained entirely free from pain with the exception of some slight twinges of pain, which I am inclined now to attribute rather to nervousness than to a real return of his disorder.

The two methods of reaching the ganglion are, first, that devised by

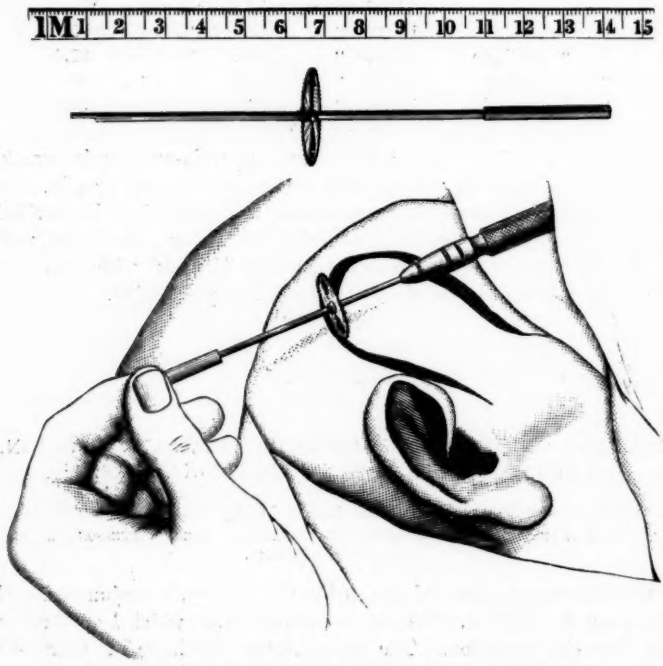
[1] Read before the Philadelphia County Medical Society, Dec. 11, 1895.

Rose, and, secondly, the Hartley-Krause operation. All of the six operations that I have done have been by the latter method, which I regard as much superior to the former: First, because of its smaller mortality, due largely to the more complete asepsis that can be obtained; secondly, because the access to the ganglion is by a large instead of a small and cramped opening; and, thirdly, because we can actually remove the entire ganglion with its roots.

I shall take up the various stages of the operation and make some remarks upon each, based on my experience in six cases, of which five recovered and one died from accidental sepsis.

First. Access to the cranial cavity. This is by means of an osteoplastic flap formed in the temporal region by a large horseshoe-shaped

FIG. 1.



Krause's method of using the circular saw with two hands. (KRAUSE.)

incision, one end of which begins immediately in front of the ear, the other about an inch behind the orbital margin of the external angular process. If the anterior incision goes nearer to the orbit than this point the operator will have to chisel through the thick bone at the lesser

wing of the sphenoid and invade the anterior fossa of the skull. The incision should be three inches vertically and three inches horizontally at its widest part. The two ends of the incision should go down toward the zygoma, in order to reach well toward the base of the middle fossa of the skull. I have had no experience with Krause's circular saw actuated by the surgical engine. (Fig. 1.) Prof. Krause last summer told me that he had found it a very safe and expeditious method of reaching the interior of the skull. One great improvement he has introduced in the saw is the prolongation of the handle directly through the centre of the saw, so that it can be held by two hands, and thus held much more firmly. In two of my cases the skull has been opened by means of Dr. Cryer's drill, a very ingenious and useful means of entering the skull. My other four operations have been done by a chisel, either Hartley's or, what I rather prefer, that of Pyle.

Second. Hemorrhage from the middle meningeal. As soon as the osteoplastic flap, made up of scalp and bone, is turned downward, there will be some hemorrhage from the middle meningeal. Even if the anterior branch does not run in a canal in the bone or in a groove so deep as to be practically a canal, some of its larger branches to the bone are torn and, usually, require ligation of the artery by means of the smallest semicircular needle of Hagedorn, threaded with silk, on account of its greater strength as compared with fine catgut.

It has been my misfortune in three of the cases to wound the posterior branch of the middle meningeal by the chisel penetrating the thin squamous portion of the temporal bone, and at the same time I have had to fight hemorrhage from the anterior branch by its being torn, owing to its passage through a complete or almost complete canal. I have met this accident by placing two fingers over the bleeding points, rapidly gnawing away the bone over the posterior branch by the rongeur forceps, securing this by a ligature, and, when once secured, releasing my finger on the anterior branch and securing that in the same way.

In one case (VI.), while lifting the temporo-sphenoidal lobe from the middle fossa of the skull, with what at the time I deemed to be great gentleness, the main trunk of the artery ruptured about one-quarter of an inch above the foramen spinosum. I was able to secure it in the same way as before, but after much trouble and the loss of a great deal of blood. The broad spatula, by which the temporo-sphenoidal lobe and dura are lifted, was of great service in controlling the hemorrhage temporarily. In two cases the artery ruptured at a still more unfortunate place, namely, immediately at the foramen spinosum, so that it was impossible to ligate it. The expedient adopted in both cases was very satisfactory in controlling the hemorrhage. The moment that I found the source of the bleeding I plugged the foramen spinosum by the curved

end of the Allis blunt dissector.[1] (Fig. 2.) I then quickly substituted my left forefinger for the blunt dissector, thus leaving my right hand free. Next, I quickly substituted a narrow strip of iodoform gauze for my finger and packed it rather tightly into the opening. This strip of gauze I carefully removed on the third day, and in neither case was there any further hemorrhage. A similar accident occurred in one of Krause's cases, and was controlled in a similar manner. To anticipate the hemorrhage from the middle meningeal Fowler tied the external carotid. From my experience I think this is unnecessary. Of course, the external carotid should be ligated, and not the common carotid, since the latter operation is not by any means free from the danger of producing softening of the cerebral hemisphere on the same side in case the circle of Willis is incompetent to re-establish the circulation.

FIG. 2.

Allis's blunt dissector.

Third. Lifting the temporo-sphenoidal lobe from the middle fossa of the skull. This is best done gently by the forefinger, and the brain, with its membranes, is then held up by a broad spatula. Separating the dura from the bone of the middle fossa is always attended with rather profuse hemorrhage, owing to the rupture of many small vessels going from the dura to the bone. This can usually be controlled by packing. In my first case I was fearful that I had torn the cavernous sinus so profuse was the hemorrhage. But experience has taught me that the source of the hemorrhage is as stated. The cavernous sinus has been torn by Finney, Krause, and others, but the hemorrhage, though alarming, has been readily controlled by packing with gauze.

In case the hemorrhage from the middle fossa is very severe I have in three cases done the operation in two stages. First, opening of the skull, separation of the dura from the middle fossa, and packing the cavity with iodoform gauze to check the hemorrhage, and three days later reopening the skull and completing the operation. The amount of packing which the brain will stand has surprised me. In one case I packed a piece, afterward found to be 37 inches by 6 inches, or 222 square inches of gauze; in another, a piece 23 inches by 14 inches, or 322 square inches of gauze; and in the third a piece 16 inches by 6 inches, or 96 square inches. In each instance the gauze remained in place for three days without any material symptoms.

I much prefer, however, to do the operation in a single stage. The

[1] This most useful yet simple surgical instrument is not as well known as it deserves to be, hence I figure it here. In all blunt dissections, which are so largely employed, it is simply invaluable, especially by the facility with which adhesions are torn through by its curved end.

danger of infection is much increased by doing it in two stages, and with a growing experience I have been able to control the hemorrhage better by temporary packing, and also have learned to facilitate the operation by the position of the head. In two of the operations the head was turned sidewise, so that the ganglion and its branches lay practically at the bottom of a well, and a few drops of blood were quite sufficient to prevent my seeing the ganglion and its branches. It is needless to say that at such a depth and with the carotid artery and cavernous sinus so near no prudent surgeon will manipulate unless he can see clearly exactly what he is doing. I find, as would naturally be supposed, that it is much better to operate with the head resting on the occiput and with a bright side-light. By this means the blood runs out as rapidly as it accumulates and does not obscure the parts, and I have found that a good side-light, with the head in this position, obviates the need for an electric light.

Fourth. Recognition and treatment of the ganglion and its second and third divisions. As soon as the hemorrhage in the middle fossa is stopped by temporary packing and sponging, the points of exit of the second and third divisions of the ganglion through the foramen rotundum and foramen ovale can be recognized by the folds or lines of traction produced by lifting the dura. These lines of traction converge at the foramina. Another guide to the third division also is the main trunk of the middle meningeal, which lies at a distance outside the foramen ovale, varying, as Taylor has shown, from $\frac{2}{16}$ to $\frac{9}{16}$ of an inch. The ganglion lies at the junction of the axes of the second and third divisions, and the object of the operator is now to completely uncover and separate the second and third divisions, and then the ganglion itself, from the dura. For this purpose I have found the best instrument to be the curved end of the Allis dissector. The dura is gently but firmly drawn back in the axis, first of the second, and later of the third divisions of the nerve, and when the ganglion is reached, by still further traction on the dura, the entire ganglion can be disclosed. It appears like a network of fibres. Having isolated the ganglion and the two divisions, not only from the dura above, but also underneath them, the best way to remove the ganglion with its divisions and its roots is as follows: First, *seize the ganglion itself* with a pair of hæmostatic forceps; then, and not before, as Krause[1] has pointed out, cut the second and third divisions at their foramina; and lastly by a gentle but firm rotation of the forceps the ganglion and its divisions can be avulsed, usually bringing with the mass the sensory root, and, as in my own last case, the motor root all the way back to the pons. (Fig. 3.)

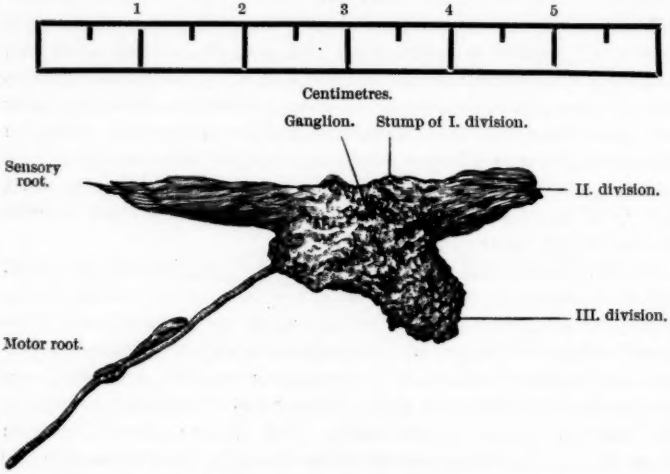
If the second and third divisions are cut at the foramina before the ganglion is seized and an attempt is made to tear them and the gang-

[1] Archiv klin. Chir., 1895, l. 469.

lion out, I found in several cases that the two divisions will generally tear off from the ganglion and the latter be left behind.

It is then difficult, if not impossible, to seize and remove the ganglion. In fact, I believe that in almost all, if not absolutely all, of the

FIG. 3.



Gasserian ganglion with the II. and III. divisions and the sensory and motor roots removed from Case VI. The nerve fibres are well shown. The motor root is elongated by the accidental reversal of one of its bundles. (From a photograph which unintentionly was enlarged about one-third, but the scale of centimeters which was photographed with the specimen will serve for comparison.)

cases heretofore reported except those of Krause[1] and my last case (Case VI.), the operation has consisted in dividing and tearing away the second and third divisions and then "breaking up" the ganglion by the curette, hooks, or other instruments. It is very doubtful to my mind whether by the method we do more than partially destroy the ganglion; certainly we do not "remove" it. In only two of my cases were any ganglion cells found in the tissue removed from the supposed position of the ganglion, and yet I endeavored to break it up and remove it as completely as possible. Whether it is actually needful to remove the entire ganglion, or whether its partial destruction is sufficient to cure the neuralgia permanently, will be discussed later. If it be needful wholly to remove it, then the *technique* above described will be necessary. The establishment of this *technique* we owe to Krause.

The first division is, of course, not meddled with, since it penetrates the cavernous sinus, but the ganglion is torn away from it. Occasion-

[1] Loc. cit., Pl. VI.

ally a considerable part of the first division comes away with the ganglion.

Mr. Horsley[1] is of the opinion that it is impossible to remove the entire ganglion without seriously wounding the cavernous sinus, but the specimen which I show you from my last case (see Fig. 3) as well as the specimens photographed by Krause prove that the ganglion can be removed in its entirety. Until I saw the photographs of Krause I had been of Horsley's opinion, but I have been compelled to change that opinion.

Clinically, therefore, cases of intra-cranial neurectomy of the fifth should be carefully divided hereafter into two classes: First, those in which the ganglion has been merely more or less broken up; and, secondly, those in which it has been wholly removed; and the result of any recurrence or non-recurrence of the neuralgia should be carefully correlated with the removal or non-removal of the ganglion itself.

Mr. Horsley,[2] in one case, opened the dura, lifted the middle lobe of the brain, and tore out the roots of the ganglion from the pons. The operation, as I have described it, accomplishes the same result with a considerably less danger of mechanical injury because the brain tissue is protected by the fibrous dura, and there is less danger of infection.

The connection between the ganglion and its sensory root apparently is so strong that this root almost always comes away with the ganglion (see Krause's photographs). In my last case the slender cord, passing under the ganglion, cannot, it seems to me, be other than the motor root. Whether it would be possible to separate the motor root from the ganglion and the third division, I do not yet know. I should propose in another suitable case to see whether it is not possible to lift the ganglion, separate it and the third division from the motor root, and then by cutting the third division of the fifth in a direction away from the motor root, possibly to preserve this nerve.

Fifth. Effects of operation on the ganglion upon the cornea. The first operation done by Mr. Rose resulted in the lost of the eye from the trophic changes, induced by the destruction of the ganglion. He, therefore, recommended and practised later stitching together of the eyelids, which, however, has been done in very few cases. I have not seen reported any other cases of serious trouble with the cornea.

In my first four cases I had no such trouble, though I did not stitch the lids together. In Case V., in which the destruction of the ganglion was more complete than in the first four, though the ganglion itself was probably not removed, a corneal ulcer formed shortly after the operation, though I protected the eyeball for four days by an occlusive dressing. I suspect, however, that the lids were opened under the dressing

[1] Brit. Med. Journ., 1891, ii. 1249. [2] Loc. cit.

and abrasion of the cornea took place without the patient's knowledge, since it was of course entirely anæsthetic. This led me in Case VI. to prevent the opening of the eyes by passing three stitches through the skin of the lids. After four days, there being some slight irritation around the stitches, I cut them and found the eyeball in perfectly good condition. Twenty-four hours later a corneal ulcer had begun to form, and the conjunctiva was very distinctly reddened. To prevent further trouble Dr. de Schweinitz freshened and stitched together the middle fourth of the lids, so as to get union of the two lids. This left the two ends of the palpebral fissure open for the escape of the normal secretions and for syringing. After a few days the lids separated by the giving of the adhesions, and in two days required to be restitched on account of renewed trouble. After a time, if we may judge from experiments upon animals, the lids may be separated and the cornea will not suffer from ulceration. Turner (*Brit. Med. Journ.*, November 23, 1895, p. 1279), from a number of experiments upon animals, concludes that "there is no evidence of trophic influence exerted by the Gasserian ganglion upon the cornea; and that, provided septic organisms are excluded, the ophthalmic branch may be safely divided or the Gasserian ganglion removed without fear of the disorganization of the eye." If this be true the explanation of the trouble in my cases lies in the imperfect asepsis of the eye. But the contrast between my first four and my last two cases, in the latter of which more care was used than in the former, and the speedy relief following protection of the cornea by stitching the lids make one doubtful of its truth in man. V. Hippel (*Archiv f. Ophthol.*, 1889, xxxv. 2, p. 217) considered the subject from the experimental side, and says that microorganisms are of no etiological importance, but ascribes the changes chiefly to drying of the cornea, which he remedies by a moist atmosphere. My own case seems to support this view and the theory of traumatism from exposure of the anæsthetic cornea.

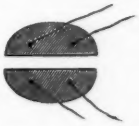
It is noticeable that this corneal ulceration followed only in the two cases: one of extensive destruction and the other of absolute removal of the ganglion. Krause has reported eight such complete removals with one death. One of the seven that recovered was suffering from chronic conjunctivitis at the time of operation. A corneal ulcer formed, but was cured. None of the others suffered.

In future I shall unite the two lids in the centre and keep them united for some time after the operation, in order to make sure of the safety of the eye, or else advocate the expedient which has occurred to me since my last case was operated on. The late Dr. Levis, after his cataract operations, to keep the eyelids closed, used to place a semi-oval piece of adhesive plaster on each lid, the plasters acting as splints and preventing the separation of the eyelids. I should propose to use the same means,

supplemented, if necessary, by two threads sewn through the plaster only (Fig. 4). Should the plaster not be sufficient to keep the lids together, the threads could be tied in a bow-knot, thus enabling one to separate the lids for inspection of the cornea and for medication of the eye, and at the same time to readjust them and keep them in approximation. The plasters should be of the entire width of each lid.

Since the above was written I have tried another method, suggested by the nurse in charge of Case VI. A large oval piece of plaster, with

FIG. 4.



Two pieces of adhesive plaster with threads, to be applied to the two lids and tied together.

a narrow slit corresponding to the fissure of the lids, is applied to the lids and seems to retain them well in apposition, and at the same time allows of inspection and medication of the cornea.

This raises also the question as to whether the more or less complete destruction of the ganglion, which has been done by most operators, is not sufficient to cure the neuralgia and whether the avulsion of the entire ganglion may not be a needlessly severe operation, especially by the peril to the eye. It does not seem thus far to have increased the mortality, but I suspect it does increase the danger to the eye in spite of Krause's happy experience and Turner's recent experiments. If time shows that the cure of the neuralgia by simply breaking up the ganglion is permanent, I should certainly be content with that. The fact that there have been a few moderate relapses, however, makes me suspect that the removal of the ganglion itself may be necessary. The intracranial avulsion of the second and third divisions from the ganglion, leaving the ganglion intact, does not seem to suffice, for in one such case Krause was obliged later to remove the ganglion itself to cure a return of the neuralgia. We shall be in a position within a few years to decide this question positively.

Sixth. Results as to recovery and cure. The most complete statistics that have been given of the mortality of the operations are those in Krause's recent paper, in which he has reported that in twenty-two cases done by Rose's method, the mortality has been 4 or 18 per cent., whereas in fifty-one operations by the Hartley-Krause method, the mortality has been only 5 or 9.8 per cent. The mortality, therefore, is much less by the latter method. It is quite certain also that if we regard the removal of the ganglion itself as an important step in the operation, this is impossi-

ble by Rose's method, since we are working in so small a space as to make it impracticable to see and manipulate the ganglion.

As to the permanence of the cure this seems to be thus far more satisfactory than the results from any of the peripheral operations. The only recurrences that I have seen reported are one case of Rose's and two of my own. Rose's was only a partial return, and my own two are very probably not true recurrences which will lead to a relapse. At the same time I have thought it right to state the facts exactly as they exist (see Cases I. and II.).

To give all my six cases to date I reproduce a short summary of the first (published in full in the *Transactions* of the Philadelphia County Medical Society for 1894), with rather fuller histories of the other five heretofore unpublished cases.

CASE I. *Breaking up of the Gasserian ganglion after thirteen prior operations. Done in two stages on account of packing to arrest the hemorrhage; recovery; cure for twenty-six months; possible slight return(?).*—Dr. K., aged forty-one years. He had suffered from neuralgia for thirteen years and had had thirteen operations done, including removal of a large part of the upper jaw, as well as various branches of the nerves. The anterior branch of the middle meningeal passed through a canal and was, of course, torn in turning down the flap. In chiselling the posterior portion of the flap, the posterior branch was also divided and the dura wounded. Both vessels were secured after much trouble. The hemorrhage, on lifting the middle lobe, was so great that the cavity was packed and the operation completed in a second stage after three days, the ganglion being broken up. The piece of gauze was found to measure thirty-seven by six inches, or two hundred and twenty-two square inches. This remained in the skull for three days, during which time his temperature had risen to 100.8°, and the respiration had gone down to from six to ten in a minute, with a slight aphasia. Immediate recovery followed the completion of the operation. He has suffered from temporary twinges of the pain, but except these he has been free from pain, and is present to-night for your examination.

CASE II. *Breaking up of the Gasserian ganglion in two stages after eight prior operations; recovery; cure for eighteen months; possible slight return.*—C. H. B. was kindly sent to me on June 14, 1894, by Dr. John B. Roberts (who was leaving town). His neuralgia began in April, 1886, shortly after a dentist hammered the gold filling into a tooth so hard as to give him great pain. Soon after the neuralgia began, all his teeth on the right side of the upper jaw were removed. A large number of drugs were tried without relief. In 1889 subcutaneous neurotomy was twice done. In March, 1890, the antrum was drilled. In April, 1890, Dr. Roberts removed several polypi from the nostrils, straightened the septum, and, later, resected a portion of the right infra-orbital nerve. In May, 1890, and again in November, 1890, the infra-orbital was resected for the second and third times by Dr. Roberts. January 31, 1891, Dr. Roberts tied the right carotid. In March, 1890, before Dr. Roberts saw him, the sight of his right eye began to fail, and in February, 1891, his physician in Florida stated that he had a glaucoma of the right eye, for which he removed the crystalline lens. When

I first saw him in June, 1894, the right eyeball was shrunken, the cornea opaque and thickened, and the eye utterly useless. The lids could not be completely closed. The right face was shrunken over the region of the antrum. For three years he had never been free from excruciating pain.

Operation, June 18, 1894, at the Orthopedic Hospital. The anterior branch of the middle meningeal ran in so deep a groove as to be practically a canal, and the artery was torn in turning the flap down. It was immediately secured by a ligature. On lifting the temporo-sphenoidal lobe, the hemorrhage was so profuse that I finally packed the wound with gauze and closed it temporarily for three days.

June 21, 1894. The gauze, when removed, measured sixteen by six inches. A culture was made at the first stage of the operation, and again at the second stage another culture was made from the inner end of the iodoform gauze, which had been in the skull for three days and looked as if there were pus on the end of it. Dr. Kyle reported that both tubes proved to be entirely sterile.

The second and third divisions were torn loose from the ganglion, the pocket for the ganglion readily found, torn open, and the ganglion broken up. The tissue, which was supposed to be removed from the site of the ganglion, was given to Dr. C. W. Burr, the pathologist of the hospital, who reported that there were neither nerve-tubules, nor nerve-cells to be found. During the three days between the first and second stages of the operation, the temperature had gone up to 102°. The day after the gauze was removed and the ganglion broken up, the temperature fell to 99°. In four days he was out of bed, and in ten days entirely well.

On July 3d Dr. de Schweinitz enucleated the right eyeball, both as a cosmetic operation and to avoid possible mischief to the other eye. The operation was done without an anæsthetic. He complained slightly of pain, the worst being felt when the scissors were thrust well back of the eyeball and the optic nerve divided. At no time has there been a single spot of complete anæsthesia over the entire face. He writes me November, 1895, that he had lately had a short attack of pain. Whether this is a precursor of a return of his neuralgia time must determine. From the experience of Case I. there is reason to believe that it will not prove to be so.

Case III. *Breaking up of Gasserian ganglion after two prior operations; rupture of the middle meningeal at the foramen spinosum; infection during operation; death from septic meningitis.*—Mrs. E. E. H., aged sixty-three years, was admitted to the Jefferson Hospital, February 19, 1894. At Christmas, 1882, she fell, striking the nape of her neck on the edge of a marble step. A month later she began to suffer lancinating pains, starting above the left mental foramen and radiating over the entire lower and upper jaws and in the temporal fossa, sometimes also as far down as the clavicle and extending to the tip of the tongue.

In 1889, at the Orthopedic Hospital, Dr. Morton removed a portion of the inferior dental nerve. The pain was entirely relieved in the lower jaw, but later returned there and at the tip of the tongue.

Second operation. She was admitted to the Jefferson Medical College Hospital, February 23, 1892, when I removed the inferior dental and lingual nerves by trephining the vertical ramus of the jaw. This method, which weakens the ramus less, I judged better than that of Horsley

(*Brit. Med. Journ.*, 1891, ii. 1192), in which he deepened the sigmoid fossa between the condyle and the coronoid process of the jaw. She was entirely free from pain until November, 1893, when it recurred again, especially in the region of the left side of the nose and cheek, the pain being described as resembling "forked lightning." It is typical of the worst form of tic douloureux. At no place is there complete anæsthesia on the left side of the face, but, on the contrary, a large part of the skin is hyperæsthetic. The pain now exists in both the second and third divisions of the fifth.

Operation, Jefferson Hospital, February 20, 1895. The anterior branch of the middle meningeal ran in a canal and was ruptured. The bone was divided by Dr. Cryer's drill.

In lifting the temporo-sphenoidal lobe, the middle meningeal ruptured directly at the foramen spinosum. The hemorrhage was arrested by plugging the foramen with the Allis dissector, then substituting my left forefinger for the dissector, and then substituting a piece of gauze for my finger.

During the operation an assistant, when my back was turned, inadvertently placed one of the drills in his mouth, and, without disinfection, it was used in completing the section of the bone. From this, to me unknown, source of infection, unquestionably, the wound became infected. On the second day her temperature rose rapidly, and at the end of a week she died. The post-mortem showed that death resulted from septic meningitis, pyogenic cocci being found by culture.

The hemorrhage of the middle meningeal, which I arrested with a small bit of gauze, was not a serious element in the case, since the amount of blood lost was not very great, and on the third day after the operation the gauze was removed without further hemorrhage.

Case IV. *Breaking up of Gasserian ganglion after five prior operations; done in two stages on account of hemorrhage; packing with gauze for three days; recovery; cure for seven months; necrosis of the bone in the flap.*—Mrs. S. R., aged sixty years. She was kindly referred to me by Dr. Clara T. Dercum, May 21, 1895. She has been a typical sufferer with facial neuralgia for five years in the second and third divisions of the right fifth, for which Dr. Steinbach has done five operations on these two divisions, the last one being a division of both branches just beyond the foramen rotundum and foramen ovale.

Operation, May 23, 1895. Profuse hemorrhage occurred on turning down the flap, in consequence of rupture of the anterior branch of the middle meningeal, which ran in a very long canal in the bone. It was secured by catgut ligature, when the hemorrhage ceased. Again on lifting the temporo-sphenoidal lobe, the hemorrhage was so great that after spending a good deal of time I found it impossible to see clearly the later steps of the operation, and therefore packed with a piece of gauze, afterward found to measure 23 inches by 14, or 322 square inches. Three days later, May 26th, I reopened the wound, removed the second and third divisions, and broke up the ganglion. Five days later, all the stitches were removed and the wound was found united excepting at the two ends of the incision. From these a few drops of pus escaped. While the gauze remained in the head, her temperature was 100° to 101° and she seemed a little drowsy; the latter may have been due to opium which was required to quiet her pain, which did not cease until a number of days after the operation. Two days after the

gauze was removed and the second stage of the operation completed, her temperature fell to the normal, and she went home shortly after. A slight discharge has continued from the two ends of the incision, and at a third point, which later reopened, and some fragments of bone have been discharged. She has, however remained entirely free from pain.

Dr. Kyle reports that he found "undoubted ganglion cells in the tissue removed. The central portion of the section showed slight, if any, variation from the normal, but the outer portion showed some inflammatory infiltration. Sections of the nerves showed a thickened neurilemma (inflammatory) with infiltration of round and spindle cells. There was no apparent change in the axis cylinders or the white substance."

CASE V. *Curetting of the Gasserian ganglion after two prior operations. Rupture of the middle meningeal at the foramen spinosum. Post-operative corneal ulcer; recovery; cure for two months.*—Mrs. F., aged fifty-four years; first consulted me at the instance of her son, Dr. F., July 15, 1891. Twelve years previously she had a small abscess at the root of a lower right molar tooth, and from that trouble dates her neuralgia. The pain was at first confined to the inferior dental nerve. All of her teeth were removed and various drugs used with more or less success. In 1887 she consulted Dr. William Pepper, and on April 29, 1888, Dr. Agnew removed a half-inch of the inferior dental nerve. This gave relief for eighteen months, when her neuralgia returned, involving the superior maxillary division. In 1891, when she saw me, the pain existed in the distribution of both the second and third divisions of the fifth. It was the usual frightful pain of tic douloureux. Her face was extremely hyperæsthetic.

Second operation, July 17, 1891. At the former trephine opening in the lower jaw just above its angle was a small opening through which some fibrous tissue passed. I trephined at the same point and found the nerve reproduced and thickened to about the size of the median nerve. I removed an inch and a half of the nerve by avulsion and then removed the superior maxillary nerve, dividing it well back of the infra-orbital canal.

This operation gave her relief for another eighteen months or two years, when the pain returned as bad as ever. Her physician, Dr. Moore, of Spartanburg, S. C., brought her to see me early in October, 1895. I recommended and she accepted an operation on the Gasserian ganglion.

Third operation, October 6, 1895. The ordinary Hartley-Krause osteoplastic operation was done. In chiseling the lower part of the incision just in front of the ear, the posterior branch of the middle meningeal was divided, although I took every precaution not to go through the bone, as in a woman of her age and so thin as she, I judged that the bones of the skull were probably very thin.

As soon as I turned down the flap of bone, I found that the anterior branch of the middle meningeal went through a canal and was torn, and the posterior went through a very deep groove, in which my chisel had divided it. In addition to this, there was a rent in the dura, which must have been made by the chisel penetrating, without its being perceived, into the interior of the skull cavity. I finally succeeded, with great difficulty, in securing the posterior branch; the anterior was comparatively easily controlled. I then carefully lifted the dura from the middle fossa, but in doing so the middle meningeal tore directly at the

foramen spinosum, and a profuse hemorrhage followed. I was able, however, to arrest this by getting the curved end of the Allis blunt dissector into the canal and then substituted, first, the forefinger of the left hand and then a piece of iodoform gauze, by which I controlled the bleeding completely.

I then exposed and cut the second and third divisions at their foramina, grasped them with forceps, and endeavored to avulse the ganglion with them. The two branches each tore off from the ganglion, but I was able to scoop out most of the ganglion with a curette. What I took to be the cavernous sinus was perfectly visible and avoidable.

The small piece of gauze packed into the foramen spinosum was brought out through the wound and the wound closed with interrupted silkworm-gut sutures.

Dr. Kyle reported on the tissue which was supposed to be the ganglion that it was undoubtedly portions of the ganglion, since he found nerve cells as well as tubules in the tissue.

Three days after the operation, I very carefully removed the small bit of iodoform gauze which blocked up the middle meningeal artery, and no hemorrhage followed. The wound was healed in the course of a week.

On the third day after the operation her eye became red and a corneal ulcer began to develop. I placed her in charge of Dr. de Schweinitz for the ulcer of the cornea. In spite of the utmost care, this broadened and deepened to a considerable extent, and at one time was very threatening, but by long-continued treatment by atropine, boric acid solution, hot compresses, bandaging the eyes with the greatest care, etc., she finally went home, November 27, 1895, with a distinctly healing ulcer and without any pain.

CASE VI. *Removal of the entire Gasserian ganglion, with its second and third sections and its sensory and motor roots back to the pons in a piece 4 centimetres long, after four prior operations; recovery; cure for three weeks; post-operative corneal ulcer.*—C. H. E., aged thirty-three years, was kindly placed under my care in the Orthopedic Hospital by Dr. M. H. Cryer, November 16, 1895. Family and prior personal history negative. Five years ago had an attack of diphtheria, and soon after this his trigeminal neuralgia began on the right side of his face. At first the attacks occurred about once in a month, but increased in frequency and severity until September, 1894, when they became almost constant. In March, 1895, the teeth on the right side of the upper jaw and the alveolar process were removed. Since then he has had three other operations done, including removal of the infra-orbital nerve and opening of the antrum. The most tender spot in his face is at the angle of his mouth, though the pain includes both the first and third divisions of the nerve, as well as the second. Even conversation is scarcely possible to him.

Medical treatment has been employed without any permanent relief. Dr. de Schweinitz and Dr. Archibald Thomson kindly took charge of his eyes. The latter examined his eyes November 18, 1895, and reported the pupils, disk, fundus, and muscular balance normal, but that he had hypermetropic astigmatism 2 D. in each eye.

Operation, November 22, 1895. In view of the trouble which I had with the eye in Case V. I decided to stitch the lids together as the first step of the operation.

The Hartley-Krause operation by an osteoplastic flap was done.

When the skull cavity was opened the anterior branch of the middle meningeal was torn at a point where a large branch penetrated the bone. This was ligated with catgut. On lifting the temporo sphenoidal lobe from the middle fossa a furious hemorrhage took place in spite of the fact that I had done it only with my finger and with the greatest gentleness. I packed it for a few moments with iodoform gauze, and then on withdrawing the gauze and lifting the brain by a spatula I found that it came from the middle meningeal, about one-quarter of an inch above the foramen spinosum, where the artery had ruptured. I could see no reason for its rupture at that point. With very great difficulty I was finally able to pass a fine silk ligature under the dura, encircling the vessel and securing it. I soon brought into view the second, and, later, the third divisions of the fifth nerve. With the curved end of the Allis blunt dissector I was able to uncover the second division and then the third as far back as the ganglion, and then with the same instrument gradually to push the dura back and disclose the entire ganglion. Following Dr. Krause's advice (*Arch. klin. Chir.*, l. 469), I then seized the ganglion itself with a pair of hæmostatic forceps before I divided the two branches at the foramina. I next cut the branches at their foramina, and then slowly and most carefully twisted the forceps which had hold of the ganglion itself, and the sensory root as far back, I judge, as the pons tore out quite readily. With it also was a much more slender filament, which went under the ganglion, and which I deemed to be the motor root. (See Fig.3.)

The length of the entire specimen from the anterior end to the end of of the sensory root is 4 cm., and to the end of the motor root 5 cm. From the ganglion the second division measured 13 mm., and the third division 9 mm. From the ganglion to the end of the sensory root was 2 cm.; to the end of the motor root 3 cm. The moment that the ganglion was torn out it was unfolded and photographed, and then placed in Müller's fluid.

On tearing out the ganglion quite a profuse hemorrhage occurred at that point. I judged it to be at the aperture in the cavernous sinus, where the first branch was torn loose. I packed it quickly with iodoform gauze, and, finding that temporary packing did not arrest it, I packed it with a fresh strip 10 inches long and 1½ inches wide, and then closed the wound.

The operation was long (two hours) on account of the difficulty in dealing with the hemorrhage. I did not use any electric light, as I found a good side-light with the head resting on the occiput was very excellent, and this position of the head is more favorable to manipulation, since the blood flows out more readily than if the head is turned with the operation side up, when the blood accumulates at the bottom of the cavity, the very place where one wishes to see well.

He was placed in bed in very good condition with very moderate shock. Later in the afternoon I was called to see him on account of some bleeding. I found two small vessels on the edge of the flap had been bleeding somewhat, but the hemorrhage ceased immediately on my ligating them.

The next day, November 23d, I found that he had passed an uncomfortable night; was complaining greatly of frontal headache, and his temperature had steadily risen until it reached 104°. I was persuaded that this was due either to pressure from the gauze or to the retained wound-fluids and the absorption of their fibrin ferment, or to both causes.

That pressure alone could do it I doubted, in view of my experience with three prior cases. I was very loth to remove the packing as early as twenty-four hours, fearing the recurrence of hemorrhage, but I was forced to do it. Accordingly, I removed it very gently, and was happily surprised in finding no bleeding; only about an ounce of bloody serum escaped. The wound in the skin was kept open by a small bit of iodoform gauze to the depth of half an inch. Within an hour his temperature was down to 99° and his headache gone. From that time he made a speedy and uneventful recovery, and the stitches were all removed on the eighth day.

Four days after the operation it was thought that the stitches in the eyelids, which were producing a little irritation, could be removed with safety. The eyeball appeared entirely normal. Within twenty-four hours, however, signs of corneal ulceration began, and on the sixth day Dr. de Schweinitz, without any anæsthetic, freshened the edges of the lids and stitched them together in the middle, the ends being left open in order that the secretions might escape, and also for purpose of irrigation. No pain attended the operation.

When Dr. de Schweinitz stitched the eyelids together he noted the following conditions of the cornea: The exact centre of the cornea is occupied by an area 3 mm. by 4 mm. of loss of superficial epithelium, with a slightly corrugated edge. Upward and outward from this is a small corneal infiltration; there is slight œdema of the upper lid. Vision in the right eye, 20/100; in the left eye, 20/40. In four days the corneal irritation subsided entirely. The adhesion between the lids gradually yielded, and the lids were separated after five days. The eye was meantime protected by a gauze dressing. In two days after the separation of the lids the cornea again became ulcerated, and the conjunctiva reddened so that the lids were again stitched together. The eye is now improving.

Dr. John K. Mitchell kindly examined the sensation for me and reported as follows:

"November 28, 1895 (sixth day). The right half of his face is wholly anæsthetic to touch, pain, and temperature change (the tongue included). Sensation is dull for pain upon the whole left (sound) side; perception slow; prick only felt as touch if superficial; when pricked deeply says it gives "pain, but not severe." This paræsthesia exactly follows the same distribution as the total anæsthesia of the operated side, ceasing upon the under surface of the inferior maxilla, so that the central part of the throat back of the chin is normally sensitive, and normal sensation is present from there downward. Sensation to heat and cold was accurate upon the left side, and their perception and differentiation were as rapid as in health. It was not possible to test taste at this time.

"December 7, 1895 (fifteenth day). The left side presents wholly normal sensibility in all forms to-day, and no delay in appreciation of touch or pain is to be discovered. The line is sharply drawn at the median line of the face. Total anæsthesia and analgesia upon the right, normal sense-perception on the left.

"Taste is wholly lost to all forms of stimulation upon the right half of the tongue and all the way back to the root, if the patient's statements are correct. Tests were made with salt solution, sugar solution, and vinegar.

"Touch and pain sense are absent upon the right side of the tongue also, and upon the gums of the right jaw."

The specimen has not yet been examined. Dr. Kyle will make a full report of its condition hereafter.

REVIEWS.

SYSTEM OF SURGERY. Edited by FREDERIC S. DENNIS, M.D., Professor of the Principles and Practice of Surgery, Bellevue Hospital Medical College; Visiting Surgeon to the Bellevue and St. Vincent Hospitals; Consulting Surgeon to the Harlem Hospital and the Montefiore Home, New York; President of the American Surgical Association; Graduate of the Royal College of Surgeons, London; Member of the German Congress of Surgeons, Berlin. Assisted by JOHN S. BILLINGS, M.D., LL.D. Edin. and Harv.; D.C.L. Oxon.; Deputy Surgeon-General, U. S. A. Vol. II. Minor, Plastic, and Military Surgery; Diseases of the Bones; Orthopædic Surgery; Aneurism; Surgery of the Arteries, Veins, and Lymphatics; Diseases and Injuries of the Head; Surgery of the Spine; Surgery of the Nerves. Philadelphia: Lea Brothers & Co., 1895.

ANOTHER volume of this important work will be received with universal satisfaction by the medical profession. Minor Surgery receives excellent treatment at the hands of Henry R. Wharton. Bandaging is finely illustrated from photographs, though exception must be taken to a very few old cuts. An impossible illustration of leg-ulcer bandaging, copied from Liston, is an example. While this portion of the work is not intended to present treatment, the statement on page 105 that electrolysis has been applied with success in the treatment of malignant growths is open to question. In washing out the bladder a funnel and tube makes a cleaner and safer apparatus than the rubber bulb and stopcock advised. Reference should be made to the prevention of catheter cystitis. Using the female catheter by touch, as here advised, is a prolific source of bladder disease, owing to contact with vaginal secretions, and is seldom justifiable.

The Plastic Surgery of to-day is described in an admirable article which does not fail to give details of method, sizes of flaps, strength, of solutions, practical points of dressing, all of which seemingly minor matters are so essential to success. The subject of hare-lip receives particularly intelligent treatment. The functional derangements due to cleft palate receive consideration. The uses and defects of prosthetic appliances are discussed as well as operative treatment. While it cannot be denied that the employment of the apparatus of Kingsley and Süersen and others gives the best fuctional results as compared with those following the most successful operations, it is still true that certain cleft palate cases should be operated upon. Acquired defects of the hard palate, not due to syphilis, are considered not infrequent. They are best treated by apparatus, as failure is the rule after operation. The use of normal salt solution is frequently mentioned as desirable in delicate plastic work. Decalcified bone chips or plates are considered

the best material for bone grafting. Buttons of bone should be replaced after trephining, though they merely serve as scaffoldings for infiltration by bone-forming cells.

Because the surgeon in civil practice may at any time be called upon for military duty the incorporation of an article on Military Surgery is most wise in a work of this character. Lieutenant-Colonel W. H. Forwood, of the United States Army, has been selected as its author. Much which has been believed in the past will have to be revised after an experience not yet attainable with new projectiles, and aseptic methods in the field. The writer pertinently remarks that there will be fewer doubtful cases as the effects will be more definite. That the small calibre bullet rarely remains in the body, that it rarely deforms even against bone, and rarely carries clothing or infectious material into the wound, are new features of the greatest importance to the surgeon and the patient. The problems of field service are here presented in a most sensible and practical manner. The standpoint of the writer is especially to be commended as meeting the demands of aseptic work while avoiding hopeless effort to do what becomes impracticable under the conditions of actual battle. A key-note is the preparation for care of the wounded as near as possible to the field as against long and dangerous transportation to division or general hospitals. Plea is made for lightly equipped flying ambulances and pack mules. The place which heat will occupy in securing asepsis in the field is fully recognized.

To Nicholas Senn has been assigned the discussion of Diseases of Bones, resulting from Malnutrition and from Infection. The former are considered to be Rachitis, Osteomalachia, and Fragilitas Ossium, though he considers that the microbic origin of some of these will undoubtedly be shown. Microbes reach the weak point through the circulation, when no lesion exists. In osteomyelitis the gastro-intestinal canal is undoubtedly a more frequent route through which infection takes place than is generally supposed. Early operation is strongly urged before any appreciable swelling has appeared. In the late operation the author uses his well-known method of filling the involucrum with decalcified bone-chips. In tubercular osteomyelitis, parenchymatous injections constitute an important part of the treatment. Typical resection should be avoided, if possible. Surgeons limit the operative procedure more and more to the removal of the diseased tissue, in place of typical resection.

Orthopædic Surgery is written from the standpoint of the true specialist by V. P. Gibney, an author of wide experience, who is not practising general surgery. In tubercular ostitis of the spine abscesses are to be let alone, if possible. Aspiration is considered preferable to incision, as long observation has taught the author that sepsis almost always sooner or later follows the latter. The direct incision upon the spine and removal of tuberculous foci is in general discouraged. The author deprecates the growing tendency to do open incision instead of subcutaneous tenotomy in connection with deformities of the feet. As to osteotomy, he finds that major operations in club-foot are seldom called for. Removal of the astragalus has much to commend it in suitable cases. The discussion of the various forms of apparatus for the treatment of hip-joint disease is most interesting and valuable. The rule is to aspirate all abscesses, no injection following. After ankle

sprains the author strongly advocates the adhesive plaster dressing with immediate use of the foot.

In an article on Aneurisms, Lewis A. Stimson reviews the general subject, while special aneurisms are considered separately by Percival R. Bolton. As to treatment, "antiseptic ligature of the artery at the nearest convenient point above the aneurism is the method most often to be selected in ordinary, uncomplicated, external aneurisms," while extirpation of the sac is doubtless to be preferred in small or medium traumatic cases, and possibly also where interference with the venous flow added to occlusion of the artery will imperil the limb. Valuable statistical information is given in considering each of the special aneurisms.

The Surgery of the Arteries and Veins, exclusive of aneurisms, is admirably presented by the editor-in-chief, Frederic S. Dennis, attention being chiefly directed to pathology and to principles of treatment, the detail of the ligation of special vessels being very properly omitted.

The Lymphatic System has but recently begun to receive the attention it deserves, though its importance to the surgeon all will admit. The very valuable article by Frederic H. Gerrish will be found to contain much that is suggestive and useful. Two colored plates show the areas drained by the various groups of channels about the head, the axilla, and the groin. These diagrams are unique and of great value. As having an all-important, because causal, relation to some diseases formerly considered surgical deformities only, a summary of all that is known of Filariasis is given. The hopelessness of treatment of elephantiasis and lymph scrotum, except by amputation, is relieved by the probability that their prevention is as easy as the boiling of drinking water.

The longest section of the volume is devoted to the Diseases and Injuries of the Head, by Roswell Park. It is impossible, in a mere review, to give a just idea of this magnificent presentation of a most important branch of surgery. Well-chosen illustrations and clear analysis aid the reader. Thoroughness is characteristic of the treatment of the subject throughout.

To the living questions in connection with Surgery of the Spine, W. W. Keen brings the light of research, of experience, and of analysis of the best present opinion. In spinal fractures with deformity not immediately reduced by extension, operation is advisable; with due limitations arising from the time that has elapsed, the region involved, and the severity of the lesion. No operation should be done when there is persistent absence of knee-jerks and other reflexes, except, possibly, the plantar reflex. An excellent study of localization methods is given, illustrated by a table of segment functions and by diagrams of nerve distribution. The *technique* of laminectomy receives clear and careful treatment.

The Surgery of the Nerves receives from the pen of John B. Roberts the attention which the importance of the subject demands. Diseases of the nerves are first considered, then their injuries, and the operations which are undertaken upon special nerves or ganglia. The whole subject is admirably presented.

The volume as a whole is entirely in keeping with the high standard expected of the work. The method of presenting signed articles gives a vitality and authority to the various sections which cannot be attained

by any method involving supposed agreement among many writers. The work cannot fail to take a permanent place as a surgical authority, decidedly cosmopolitan in tone, yet in harmony with the high standards of the best American surgery. G. E. S.

PRACTICAL DIETETICS, WITH SPECIAL REFERENCE TO DIET IN DISEASE. By W. GILMAN THOMPSON, M.D., Professor of Materia Medica, Therapeutics, and Clinical Medicine in the University of the City of New York, Visiting Physician to the Presbyterian and Bellevue Hospitals. Pp. xxii., 802. New York: D. Appleton & Co., 1895.

WE quite agree with the author that the subjects which are so fully discussed in this volume are frequently dismissed in brief and indefinite phrases by the writers upon the theory and practice of medicine. Even in systematic works upon food and dietetics, the practical needs of the careful physician are neglected in the enormous volume of chemical and physiological reports. We have read this book, keeping in mind the Pavy and the Chambers of our student days, knowing that very great and important advances have been made in our knowledge, and at the same time believing that these changes should be recognized, compared with our previous knowledge, and, at the same time, brought into harmony with the existing high standard of medical practice. To secure adaptability to the daily needs of the physician, not the work of the chemist, nor of the physiologist, should be made the standard for the determination of food values, but the findings of those working in these special lines of investigation should be studied, compared, and harmonized, not by the student in his library, but by one who, with considerable acquaintance with chemical and especially physiological literature, rounds out his attainments by carefully making use of the literature in his effort that those who may come under his professional care may have prescribed for them an appropriate diet. The fact that the author has written a successful book is due, not only to his knowledge as a chemist and his studies as a physiologist, but as well to the fact that he is a practical physician. The keynote of the volume is that the physician in the presence of pathological conditions shall here find what diet, how much, how often, and in what form food shall be administered to his patient.

Part I. is devoted to Foods and Food Preparations. These are classified for systematic study and ready reference. The uses, varieties, modifications, often the mode of preparation, preservation, and sources of contamination, are fully presented. Part II. treats of Stimulants, Beverages, and Condiments. Those substances which in various portions of the world have been found by their inhabitants, uncivilized as well as civilized, to be conducive to their comfort, are fairly discussed. While the alcohol question may not be presented in a way which will be satisfactory to the intemperate adherents to the theory that temperance and prohibition are synonymous terms, yet the author in fairness presents its physiological action and clinical uses, and yet does not hesitate to point out its dangers. Part III., on Cooking, Food Preparations and Preservatives, and Quantity of Food Required, should be read as an introduction to the remaining portion of the book; thus would the

mysteries of the kitchen be better appreciated and deadly work of the average cook considerably diminished. Parts IV. and V. give a fair idea of the Food Required for Special Conditions (age, weight, sex, race), and Food Digestion (conditions which especially affect digestion). Part VI. takes up the General Relation of Food to Special Diseases which are caused by dietetic errors, and here parasites, ptomaines, poisons, including alcoholic poisoning, are satisfactorily presented.

Preliminary to the application of the principles already enumerated is Part VII., on the Administration of Food for the Sick. The various forms of diet in its relation to diseases, covers three hundred pages, a monograph in itself. Infectious diseases, those of the respiratory, circulatory, urinary, and nervous system, diseases of the alimentary canal, liver, and skin, are grouped together, and full instruction is given as to the proper diet to be employed. The diseases especially influenced by diet—obesity, rheumatism, gout, diabetes, and scurvy—are by no means neglected. Here the author has bound himself to no theory, but offers the results of the best clinicians. Part VIII., on Rations and Dietaries, interests chiefly those under whose care come hospitals, reformatories, asylums, and bodies of men, and who are morally responsible for the good health of those dependent upon them. The Appendix is practically a well-arranged and useful Cook-book for Invalids, and its careful study would enlarge the *répertoire* of almost any physician. In a work requiring extensive reading, and one which must be to some extent a compilation, errors and omissions must be expected. We note the failure to quote Semmola with reference to egg-albumin (p. 468), the omission of diastase, now an article of commerce; and we find no acknowledgment of the value of a meat diet in certain cases of lithæmia (p. 487), although it is stated (p. 93) meat should be reduced or prohibited. We fail to understand why it may be desirable to peptonize Mosquera's beef jelly (p. 98). We are inclined to agree with the author that false teeth may add to the comfort and prolong the life of the aged (p. 482), rather than that they will not prove an unqualified advantage (p. 287). We find that the dose of pancreatin as given (p. 68) is incorrect; the quantities as given in the last formula, on p. 77, in both the metric and apothecaries' systems, do not correspond. We doubt if the author intends that "strachino" is to be taken as a synonym for "gorgonzola." On p. 152 undoubtedly "coleslaw" is a typographical error, for slaw may be defined as sliced cabbage, while cole, although belonging to the cabbage family, does not "head" as does cabbage. The book is well printed and easily read; the use of terminations in "our" instead of "or," following the British usage (colour, labour, favour), of unusual forms, as malfermentation (p. 67), and trichiniasis (p. 349) instead of the more familiar trichinosis, mar its appearance. The newer chemical nomenclature, sodium bicarbonate for bicarbonate of sodium (p. 631), would have been advantageously followed.

On the whole, the book shows that the author has industriously collected the best opinions upon the subject, that he has drawn from the results of his own experience, that he has endeavored to bring the findings of the laboratory into practical relation with the observations of the consulting room, and finally to produce a book of value to the practising physician. We believe that he has succeeded admirably in presenting a useful and readable book. R. W. W.

TWENTIETH CENTURY PRACTICE. AN INTERNATIONAL ENCYCLOPÆDIA OF MODERN MEDICAL SCIENCE. By LEADING AUTHORITIES OF EUROPE AND AMERICA. Edited by THOMAS L. STEDMAN, M.D., New York City. In twenty volumes. Vol. III. New York: Wm. Wood & Co., 1895.

VOLUME III. of the *Twentieth Century Practice* contains articles on occupation-diseases, drug habits, and poisons, in the midst of which a chapter on osteomalacia is inserted, so keeping up the curious classification noticed in the earlier volumes. The first article, on Alcoholism and Drug Habits, is by Norman Kerr. In this the author attempts—unwisely, we think—to restrict the application of so well-established and commonly-used a term as inebriety "to that overpowering morbid impulse, crave or craze, which tends to drive certain individuals to excess in intoxicants." Alcoholism is only a variety of that disease to which the term "narcomania" has also been applied by the author. The various aspects of alcoholism are well described and treatment laid down in considerable detail. The author believes in the sudden withdrawal of alcoholics in the treatment of delirium tremens, and his statement that in the workhouses of England this is the general practice carries more weight, in our opinion, than the theoretical reasons given. The author does not use any of the sedatives or stimulants popular in this country, not even hot coffee apparently, but occasionally gives a dose of opium in "incipient, slight attacks." To cause speedy elimination of alcohol, the "innocent yet powerful liquor ammonii acetatis" is used, while hot water or hot cinnamon-water replaces the beef-tea and capsicum of former days. The author utters a timely protest against the exaggerated ideas propagated by non-medical writers, and received with curious avidity by an unthinking public. "It does not follow," he says, "that because a child has intemperate or gouty parents, he must necessarily suffer from drunkenness or gout," but "has a preponderating chance of never being afflicted with either disease if he is brought up and continues under conditions unfavorable to the development of either malady." The sections on the pathological anatomy of acute and chronic alcoholism are unsatisfactory. After some remarks on ginger, eau-de-cologne, and lavender inebriety, morphinism is discussed at length. In the treatment of the latter disease the theoretical objections to the tapering-off method are not urged; on the contrary, the author recommends a gradual withdrawal extending over a term of two or three weeks or more. Cannabism, chloralism, chloroformism, etherism, and cocainism are described with sufficient fulness, and a short section follows on the effects of gelsemium, sulphonal, paraldehyde, antipyrin, arsenic, and some other drugs, with a few words on geophagy. Tobaccoism, theinism, and caffeinism follow, after which narcomania is considered from a number of aspects, medical, legal, and otherwise, the whole forming an interesting and valuable article. Shock and collapse are described by George F. Shrady. The author prefers to distinguish between these two terms, the latter being especially applicable to the "sudden prostration occurring in cases not strictly surgical, as in internal hemorrhages, perforation of the stomach or intestine, poisoning by irritant drugs," etc. It would be well if the distinction were more generally observed. The description of the clinical features of shock is admirable, and the direction for treatment, including prophy-

laxis, full and clear. Whiskey and brandy are looked on as of the first value; strychnine is recommended as a prophylactic, but the combined use of nitroglycerine with that remedy in shock proper is not mentioned. In a series of interesting chapters to which the term encyclopædic may with propriety be applied, Albert L. Gihon describes seasickness, heat-stroke, and frost-bite. In the former is a short section on the Therapeutic Uses of a Sea Voyage. Mountain Sickness is described in a scholarly chapter by George von Liebig, who considers the chief element of this interesting complaint to be a "temporary inability to supply the blood under all conditions with a sufficient amount of oxygen from the rarefied atmosphere." "Force of circumstances obliges persons living in high altitudes to adapt the work of respiration to the altered conditions." The remarks on treatment are rational. The chapter on Osteomalacia is by W. T. Councilman, who gives in brief compass an accurate *résumé* of our present knowledge of this rare disease. It is suggested that the relation of the ovaries to the disease, to which the results of castration point so strongly, is probably chemical. In the chapter on Diseases of Occupation, James Hendrie Lloyd has brought together from the extensive and scattered literature, from heads of great manufacturing establishments and from his own experience, a large amount of valuable information. The references to laws bearing on labor and occupation and the synopsis of the laws of a number of States regulating the labor of women and children are especially valuable. The great variety of trades and affections considered in this article makes a review of it impossible. A perusal of any part of it will furnish interesting and often valuable information, the original sources of which are inaccessible to all but a few. The volume closes with chapters on Poisoning by Beaumont Small and James Stewart. Altogether, the articles in this volume are of a high degree of excellence, and, though some of them are of comparatively infrequent practical application, all may be read and referred to with pleasure and profit. The mechanical execution of the book is good, the index short, but fairly adequate. A few typographical errors have been noticed, as, for example, the repetition of Petrona for Petrone, p. 242; Köhler for Kahler, pp. 247 and 248; Kuhne for Kühne, p. 247; Hæmoglobinuria, p. 244, should read hæmoglobin; Fruchtersleben, p. 285, should be Feuchtersleben. G. D.

Remote Consequences of Injuries of Nerves and Their Treatment. An Examination of the Present Condition of Wounds Received in 1863–65, with Additional Illustrative Cases. By John K. Mitchell, M. D., Physician to St. Agnes's Hospital, etc. Small 8vo., pp. 245, with twelve illustrations. Philadelphia: Lea Brothers & Co., 1895.

Only he who has himself tried to inquire into the later history of patients with the more chronic forms of nervous disease can appreciate the magnitude of the task so successfully accomplished by the author of the present work. The patient often drifts out of reach, or else, if his whereabouts be known, discouraged at the futility of treatment and worn by his sufferings, both he, his friends, and even his family physician

seem to have a rooted objection to giving any answers to inquiries, and, when answers are given, they are usually unsatisfactory, if not misleading. The difficulty becomes still greater when, as with most of Dr. Mitchell's cases, the patient has been subjected to the demoralizing influence of the pension agent, and he fears that any information as to his present condition will be used to decrease his pension. That, thirty years after the injury, the author has succeeded in obtaining the subsequent history of thirty-four cases of injury to the nerves, is itself praiseworthy, but the book itself merits much higher praise. The author has studied the later history of a part of the cases which formed the subject of the two treatises by Dr. Weir Mitchell, *Gunshot Wounds and Other Injuries of Nerves*, written in conjunction with Drs. Morehouse and Keen in 1864, and *Injuries of Nerves and Their Consequences*, published in 1872, and has added to the thirty-four cases recorded the histories of eighteen other cases of serious nerve injury. The book is thus a continuation and a worthy sequel of his father's well-known work. Analysis of such a work, however, is by no means easy. Each case presents its own individual features of interest, which are ably summarized. The various chapters treat of contusions and commotions of nerves, sections of nerves, ascending neuritis, degeneration and regeneration of severed nerves, and the treatment of injuries. The striking feature of the cases collected is their severity, although, of course, it was more natural that only the severe cases and those which had not recovered should answer the inquiries. Nevertheless, whether it be due to the nature of the original injury or the lack of aseptic treatment or not, cases of such duration and severity are to-day comparatively rare. The author has noted many curious examples of perverted sensibility and irregular trophic disturbances in the cases, and he urges that, before operating, we confirm the diagnosis of a nerve lesion by some symptoms other than pain. The chapter on ascending and migrating neuritis is full of value. As is well known experimental attempts to produce an ascending neuritis have seldom succeeded, but clinical cases are occasionally met with, and Dr. Mitchell has recorded several cases. He is inclined to believe that there is a special toxic cause, and he concludes that pressure from any cause is a frequent, though not a constant, factor in the production of a spreading inflammation, although the presence of inflammation in surrounding tissues has curiously little influence. Larger nerve trunks are more prone to present the phenomena of spreading inflammation than the smaller ones. Neuritis may spread centrifugally or centripetally, the latter being the commoner form in traumatic cases. Beside the cases of injury to peripheral nerves a few cases of spinal injury are also recorded, which are of very great interest from their bearing upon certain questions of great importance in medico-legal cases. They go to swell the proof that there are cases of very slow onset, due to injury, when the lesion is in the cord itself, with no injury to the vertebræ, and where the prognosis is grave, and they further show that some of the simple "backs," viewed with so much disfavor, may eventually develop into cases of cord disease. The author finally lays much stress on the importance of very long-continued treatment in cases of nerve injury, especially by electricity, even in apparently hopeless cases. In cases of suspected local injury or pressure he strongly urges nerve suture. In only one point can we take exception to his statements, when he speaks of the prognosis in the ordinary radial paralysis from pressure so com-

mon in drunkards, as bad, since complete and speedy recovery has been the rule in our experience.

The book will prove of extreme value to all interested in the study of nervous disease. The author has undertaken a novel task, and he has performed it most admirably. We can give it no higher praise than to say that it is a worthy sequel of the elder Mitchell's *Injuries of Nerves*.

P. C. K.

THE ASEPTIC TREATMENT OF WOUNDS. By DR. C. SCHIMMELBUSCH, of Berlin. Translated from the second German edition by ALFRED THEODORE RAKE, M.B., of London. London: H. K. Lewis, 1895.

AN English translation of this most excellent work meets an undoubted need, a need not only of the student who is seeking to grasp principles, but also of the practitioner who is endeavoring to apply them, and of the teacher who explains and demonstrates. The first German edition obtained at once a high place in the estimation of surgeons, and a second edition was demanded in a few months.

Schimmelbusch was widely known as a scientific investigator of acumen and learning and as a practical surgeon of skill and experience, a blending of capacities in the individual which gives a union of forces in his book. This volume is characterized by comprehensive grasp, breadth of view, and scientific accuracy. There are no vain chases after elusive theories. The results of the laboratory investigation are gauged, checked, weighed, and systematized by the calm judgment of the practical surgeon, a judicious fusion of theory and practice which renders this little book the most valuable exposition of the subject we have ever seen.

Schimmelbusch shows the great results which asepsis and antisepsis have brought about, demonstrates that the goal to aim at is surgical cleanliness, and that in reaching this chemical germicides are of less importance than mechanical means. He gives in detail descriptions of the simplest and best methods of preparing instruments, ligatures, sutures, dressing the skin of the patient, and the hands of the surgeon and his assistants; outlines the methods of preparation for operations in each region of the body; gives examples of preparation, operative conduct and post-operative care; outlines the procedures suitable for emergencies; insists upon thoroughness in every move, and proves that hypodermatic injections carelessly administered may be productive of most disastrous consequences. Every surgeon should own this book and every surgeon ought to study it.

J. C. DA C.

TEXT-BOOK OF DISEASES OF THE KIDNEYS AND URINARY ORGANS. By PROF. DR. PAUL FÜRBRINGER, Director of the Friedrichshain Hospital, Berlin, etc. Translated from the German with annotations by W. H. GILBERT, M.D., Physician in Baden-Baden, etc. In two volumes. Vol. I. London: H. K. Lewis, 1895.

PROF. FÜRBRINGER'S work on the Internal Diseases of the Urinary and Genital Organs, the first edition of which appeared in 1884, the second in 1890, acquired its popularity chiefly through the later chapters, on the disease of the bladder and genital organs. The part

now translated from the second edition is distinguished by the skill with which the author has compressed into a small and readable form a large amount of matter, so presenting not only sketches of the views of most of the classical writers on kidney disease, but in every chapter giving the results of his own extensive clinical experience. That the last edition was prepared five years ago renders the work somewhat incomplete in a few minor points of anatomical interest, but the chapters on diagnosis and treatment do not suffer from the lapse of time.

The work begins with an account of albuminuria, hæmaturia, hæmoglobinuria, casts, dropsy, and uræmia, which is on the whole satisfactory. Following this is a chapter on the renal alterations in Asiatic cholera and in pregnancy, congestion of the kidneys, and infarct. The various forms of nephritis are classified as follows: Diffuse nephritis, including acute nephritis, acute hyperæmia, and febrile degeneration; chronic nephritis without marked atrophy; chronic nephritis with marked atrophy and true contracted kidney; amyloid kidney; circumscribed (suppurative) nephritis. The author does not follow the old plan of speaking of the "stages" of nephritis, but considers the anatomical varieties under the classification mentioned. Under each form the etiology, morbid anatomy, symptoms, and complications are fully discussed. The treatment of acute nephritis is considered with that of the chronic diffused form, and is characterized by rational and conservative views. In the symptomatic treatment of contracted kidney Fürbringer rejects many remedies looked on with favor in America, such as nitroglycerin. His advice, "not to forget the poor patient through thinking of the remedy," is worth noting. The English volume ends with a short chapter on renal abscess. The translator does not explain why this is included in the first volume, while floating kidney, enuresis nocturna, and several other diseases often classified as internal are reserved for the surgical volume.

On the whole, the idea of presenting to English readers a work like that of Fürbringer is praiseworthy; we regret that the mode of presentation is not equally good. Sentences are omitted and the paragraphing arranged after a new method. Other sentences are so translated as to convey precisely the opposite meaning from that of the original. The book abounds with specimens of "English as She is Wrote," which might be explained, but not excused, had the book been printed, as well as translated, in Germany. How some of the errors could escape English printers is a mystery. In order that these remarks may not be ascribed to national idiosyncrasy we submit a few examples: "Permanent and uniform" becomes "intransmutable regular;" "albuminuria through disease;" "monography;" "albuminous cyclus" (for "cyclical albuminuria"); "Pavy's illness" for "Pavy's disease;" "illness of the urinary organs;" "albuminuria produced by wind instruments;" "spectrum" becomes "spectre;" "hæmoglobinuria has been described as (*nach*) a fat embolism;" "slide" is "object-glass;" "tubes" are "utriculi;" "related" is "affinate;" "clonic" is always "chronic;" "cliniker" is always "cliniater;" "picture" (*Bild*) is "allures;" patients treated by the "transpiration procedure" (*Schwitzbad*) are likely to complain of "caducity!" Curiously enough, actual typographical errors are very rare; even Hallibarton (p. 37) is so spelled in the original. There is a short table of contents, but no index. Needless to say the work cannot be recommended to serious-minded purchasers.

G. D.

PROGRESS
OF
MEDICAL SCIENCE

THERAPEUTICS.

UNDER THE CHARGE OF

REYNOLD W. WILCOX, M.A., M.D., LL.D.,

PROFESSOR OF CLINICAL MEDICINE AND THERAPEUTICS AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL; VISITING PHYSICIAN TO ST. MARK'S HOSPITAL.

The Treatment of Pneumonia.

Dr. Georges Hayem states that amyl nitrite in large doses is much less dangerous than it is commonly supposed to be. It transforms hæmoglobin in the globule itself into methæmoglobin without destroying the anatomical elements, without giving rise to globular anæmia or alteration of the blood by globular *débris*. At a single *séance* an adult can inhale, from a compress held half an inch from the nose, 60, 80, or even 100 drops. In many cases a single inhalation may be sufficient; in others two daily, morning and evening. This treatment is harmless, and can be continued during the course of the disease, and for two or three days after complete defervescence. It does not change the duration of the disease nor the temperature range. It relieves the dyspnœa, liquefies the expectoration, and diminishes the auscultatory signs. It does not possess any anti-pneumococcal properties. It is probable that the lung undergoes a marked sanguineous fluxion. At all events the heart is violently excited, its beats become stronger and more rapid, and the vasomotor effect results in facilitating the re-entrance of blood through the pneumonic areas and the absorption of the exudate.—*Journal des Practiciens*, 1895, No. 16, 2d semestre, p. 254.

Dr. Ernst Glaes quotes the enthusiastic *dicta* of Sziklai in regard to pilocarpin and reports five cases. He concludes that (1) in recent cases doses of from one-sixth to one-third of a grain give rise to symptoms of collapse. In some instances there is a rapid extension of the process and curative action in acute cases cannot be demonstrated, and its use is not to be encouraged especially in private practice. (2) In delayed resolution the remedy can be given in single doses of one-sixth to one-third of a grain twice or thrice daily and for five or six successive days, either internally or subcutaneously, without marked unpleasant after-effects. In this stage it may

bring about a somewhat rapid resolution, but in many cases it will fail. Cardiac weakness is a contraindication to its use.—*Centralblatt für die Gesammte Therapie*, 1895, Heft x., S. 577.

The Action of Ephedra.

Dr. E. Grahe notes that the similar but not entirely identical bodies, the alkaloids ephedrine-Nagai, pseudo-ephedrine-Merck, and ephedrine-Spehr possess the following action: (1) Small doses, *per os*, subcutaneously or intravenously applied, give rise to transient increase of blood pressure, slowing of the cardiac contractions with coincident increase at the beginning, and weakening of the latter as the result of a paresis of the vagal termination, and probably also of the smooth muscular fibres of the heart itself. (2) Larger doses give rise to a lowering of blood-pressure consequent to the diminution of vascular tone. (3) As constant phenomena are pupillary dilatation with disturbances of accommodation and refraction, which are probably the result of irritation of the sympathetic, and also to a less degree, of a slight paresis of the terminations of the motor oculi in the sphincter pupillæ, and finally also possibly of a paresis of the muscular apparatus of the iris itself.—*Therapeutische Monatshefte*, 1895, Heft x., S. 556.

Diastase.

Drs. E. B. Smith and E. W. Tonken report very briefly seven instances in which taka-diastase was employed with very satisfactory results in five. The conclusions are that (1) diastase was suited for cases presenting, espepecially after taking much starchy food, the following symptoms: epigastric weight and pain, bloating, drowsiness, frontal headache, with a superadded constipation. (2) The dose may be smaller than indicated (5 grains), it being found that from ½ to 3 grains are sufficient. (3) It should be given just before or after eating, or it may be mixed with food. (4) It relieves the constipation of these cases in this manner: A colloid-like unconverted starch prevents watery osmosis into the intestine; but when this same starch is converted into sugar it acts more after the manner of a crystalloid and sets up osmosis of liquids into the intestines, thus aiding the evacuation of the contents.—*Therapeutic Gazette*, 1895, No. 10, p. 670.

Strontium Carbonate.

M. E. Métral proposes this salt, hitherto unused in medicine, as a dentrifice. (1) Its detersive power is midway between that of calcium and magnesium carbonates, whose action is very slight, and that of pumice-stone, which can abrade the teeth if the enamel is of poor quality. (2) Its reaction is slightly alkaline; an advantage, for acidity is the initial cause of caries. (3) Its use is agreeable because its oily condition causes it to attach itself to the brush and to the teeth, so that it does not get into the throat and cause tickling, cough, or even nausea. (4) It is very reasonable in price. (5) The strontium salts appear to have a preservative and anti-putrid action upon the tissues, liquids, and organic excreta. The salt can be used alone, but it is better associated with an anti-fermentable substance, as flowers of sulphur,

as follows: Strontium carbonate and flowers of sulphur, of each, 37; essence of rose, 1. For a paste: Strontium carbonate, 12; flowers of sulphur, 6; medical soap, 27; essence of rose, 1; with equal parts of mucilage of acacia and glycerin sufficient to make a paste—*Bulletin Générale de Thérapeutique*, 1895, 40 liv., p. 360.

Thymol in Solution.

Dr. Hermite calls attention to the fact that the large amount of alcohol required to dissolve this drug will render its solution painful and as well make it more expensive. By dissolving in a little water, slightly warmed, equal parts of tartaric acid, caustic soda, and thymic acid, and adding water to 2000 parts, a colorless and perfectly limpid solution is obtained.—*Bulletin Générale de Thérapeutique*, 1895, 36 liv., p. 266.

The Analgesic Antipyretics.

M. Schmidt calls attention to the fact that the association of the antipyretic and antineuralgic effects is not a new thing, for Briquet, in 1842, showed that quinine, in large doses, relieved articular rheumatism. In the study of these agents one must consider their action: (1) upon the nervous system; (2) upon the arrest of protoplasmic activity; and (3) upon the blood. These drugs can be divided into six groups: (1) The phenols—represented by carbolic acid, thymol, guaiacol (creosote-phenol), naphtol, asaprol (beta-naphtol sulphonic ether). These bodies act upon microbes, are protoplasmic poisons, alter organic cells, and restrain chemical processes. They are blood-poisons, because they lower its vitality in destroying its figured elements; and they are nerve-poisons, because they depress or paralyze after a period of excitation which is rarely found wanting. Their analgesic effects are feeble, although their antipyretic effects are very active; and although they are transient, they are accompanied by grave secondary phenomena. Naphtol and asaprol are harmless; but the former is insoluble, and the latter is of so stable a combination that naphtol is disengaged only in small quantity. (2) The aromatic acids—salicylic, benzoic, and anisic. With salicylic acid must be considered salol and betol, whose action is uncertain, for they can be absorbed only after splitting up by the pancreatic fluid whose secretion is very inconstant in febrile conditions. In this group the antiseptic action predominates and they are less poisonous as regards protoplasm; their action upon the blood is insignificant when used in therapeutic doses. In very large doses, which first excite, they may later paralyze the nerve cells. Outside of rheumatism their analgesic action is weak; their antipyretic action demands considerable doses; they facilitate diuresis and make soluble the nutritive waste which embarrasses the blood in fever; they are real purifiers of the economy. (3) The anilides. This group comprises acetanilid, exalgin, formanilid, methyl-formanilid, and phenacetin. The substances break up in the organism into paramidophenol, or compounds of this substance, which is eliminated in the condition of sulphur compounds. The anilides are more poisonous for the blood than the derivatives of paramidophenol, although this is a blood-poison, transforming

hæmoglobin into methæmoglobin, and ending by destroying the blood-globules themselves. A quite energetic antiseptic, it acts upon the nervous system in a way analogous to the phenols, but more slowly and less intense. It excites at first, then paralyzes the central nervous system. When given to man it produces a rapid but temporary fall of temperature, accompanied with abundant perspiration, chilly sensations, cyanosis, and hæmoglobinuria. It markedly alleviates painful phenomena. (4) Phenyl-hydrazin. This substance is an energetic reducer. It lowers temperature, but it cannot be employed on account of its violent action upon blood-globules. (5) Quinolin. This is considered as the nucleus of the majority of the natural alkaloids, especially of quinine, and Danoth believed that it possessed antiseptic properties, an antifebrile action, and paralyzing effects upon the nervous system, but it has been abandoned because it irritates the alimentary canal. (6) Pyrrol. The most important and almost the only representative is antipyrin, to which may be added the compounds salipyrin and tolypyrin. The first possesses a real antifermentative and microbical action, is almost harmless to the blood, presents antithermic and analgesic properties which are not in any respect inferior to those of similar remedies. As analgesic, antipyrin holds the first place in point of rapidity of action and harmlessness, next comes phenacetin, less constant and less rapid. Exalgin and acetanilid are without doubt more active, but they are dangerous. They can be used for inveterate neuralgias if other remedies have failed.

M. LABORDE, from the standpoint of antipyretic and antithermic aspect, would divide the substances into two categories. The first comprises the fundamental analgesics, of which the types are antipyrin and acetanilid; but these can, under certain conditions, act upon the pyrexias especially of the continued type. Second, the true antithermics and antipyretics, which are also antiperiodics, such as quinine, and synthetic derivatives, as quinethylin and quinopropylin. One definite physiological law can be deduced, viz., every thermic moderator is necessarily a moderator of the sensitive nerve acts. Therefore the mode of action of these substances can be stated as follows: (1) The action of the antithermics is first and mostly upon the centres of sensory reception and perception. (2) It then follows that the organic centres which preside over the production or repartition of animal heat appear to be mingled. (3) We should beware of forgetting the narrow correlation which exists between the trophic phenomena and those of sensibility.—*Les Nouveaux Rêmedes*, 1895, No. 18, p. 109.

THE TREATMENT OF EPILEPSY BY FLECHSIG'S METHOD.

DR. ISABEL M. DAVENPORT has made a careful and thorough trial extending over a period of more than a year. The treatment consists of opium given in one-half-grain doses, and increased by the same dose per day until fifteen grains are reached. Then the opium is discontinued and the mixed bromides, thirty grains four times each day, were substituted. Eleven patients were treated. The author concludes that: (1) The treatment does not result in recovery. (2) That it is of benefit in that it gives many of these unfortunates a gratifying respite from the attacks, and thus adds to their comfort. (3) That it is soothing and quieting to the irritable patients and exhilarating to those suffering from depression, thus relieving distressing

symptoms in both cases. (4) That through the cessation of the seizures and other annoying symptoms the patient is enabled to enjoy something of life in general and to recuperate physically, and for these reasons I believe it is desirable to repeat it at intervals of two or three months, if thereby we can obtain the results mentioned above.—*American Journal of Insanity*, 1895, No. 2, p. 207.

The Treament of Syphilis.

Dr. Morel-Lavallée regards as provisionally demonstrated the following propositions: (1) Mercury should be the foundation of the treatment; potassium iodide is a useful accessory agent of medication. (2) The mercurialization ought to be initial, prolonged, and of sufficient dose for giving to the future a relative security. (3) The case in which the mercurial treatment has been abandoned before the end of the second year is one insufficiently treated. (4) Mercury has a preventive action against all the manifestations of the disease; the proof of this is, for example, the constantly favorable action of mercurial treatment administered with the purpose of avoiding the hereditary manifestations in the descendants of syphilitics. In case of absolute mercurial intolerance one may be forced, in default of better, to have recourse to the iodides, even in the secondary stage.—*Revue de Thérapeutique*, 1895, No. 21, p. 651.

Severe Maniacal Excitement following the Administration of Sodium Salicylate.

Dr. G. B. Robinson reports that a single woman, forty years old, who had been an inmate of an asylum for eighteen months suffering from delusional insanity, received six twenty-grain doses of this drug at four-hour intervals to relieve a subacute rheumatism which was principally located in her wrist-joints. She became restless, incoherently talkative, more excited and delirious, using disgusting and immoral expressions, and requiring the constant attention of two nurses. Recovery from these symptoms, after the use of whiskey, milk, and eggs, took place within thirty-six hours.—*Journal of Mental Science*, 1895, No. 139, p. 685.

The Treatment of Opium-poisoning.

Dr. Leedom Sharp, from elaborate investigations upon potassium permanganate, concludes: (1) That the susceptibility of lower animals to the action of morphine renders experiments on them very unsatisfactory in arriving at any results referable to man. (2) That the dose necessary to counteract the enormous lethal dose of morphine in the lower animals must of itself prove fatal. (3) That its exhibition by the stomach or hypodermatically has a marked influence in prolonging the life of rabbits poisoned by morphine. (4) That its action, when given separately from and not immediately following the dose of morphine, is not chemical, because (*a*) there is no proof of a chemical action to be deduced from the cases or experiments; (*b*) there is evidence that it does not act chemically. (5) Its action is physiological, because (*a*) there is no proof that it acts chemically, except when

brought in direct contact with the stomach. (*b*) There is evidence that its exhibition, by the stomach, or hypodermatically, increases the number of respirations. (*c*) There is evidence that its exhibition, by the stomach or hypodermatically, has an appreciable effect upon the circulatory system, as seen by the dilatation of the vessels of the ears and by the direct effect upon the blood. (6) It is not a reliable antidote, because (*a*) there is no proof that when it is given after the absorption of the morphine, it is, *per se*, a reliable antidote. (*b*) There is evidence that when it is given after the absorption of the morphine it is an unreliable antidote. (*c*) There is proof that when it is given after the absorption of the morphine it has no apparent effect. (7) It, like strychnine, caffeine, and atropine, has some valuable properties, useful in the treatment of morphine-poisoning, but as yet undetermined. "Proof" and "evidence" are not intended to be synonymous, the former being positive, the latter relative.—*Therapeutic Gazette*, 1895, No. 10, p. 561.

He also reports on the value of caffeine, as shown in a single case, male adult, who had swallowed fifteen grains of Dover's powder. Two hours after ingestion, an emetic not being at hand, he received $\frac{1}{50}$ of a grain of nitroglycerin, 4 minims of tincture of digitalis, 4 minims of tincture of strophanthus, and 5 minims of tincture of belladonna. In less than twenty minutes the pulse improved greatly in character. Now 6 grains of caffeine were given with great improvement in coma, pupils, pulse, and respirations.—*Ibid.*, 1895, No. 11, p. 732.

The Danger of Carbolic Acid in Enemata.

Dr. Herlyn reports a single case where a 3 per cent. solution of carbolic acid was used as a rectal by mistake for a vaginal injection. Fainting followed, the respiration was superficial and slow, the pulse 30 to 35 per minute, there were isolated clonic spasms, and the pupils were without reaction. About seven ounces of the solution, containing ninety grains of carbolic acid, had been used. After repeated injections of ether the pulse became stronger and the patient recovered consciousness, the night was restless, there was a profuse muco-sanguinolent diarrhœa and the stools were of the odor of carbolic acid; the urine was not characteristic. Recovery followed in five or six days.—*Deutsche medicinische Wochenschrift*, 1895, No. 41, S. 683.

Immunization Against Diphtheria.

Dr. George A. Peck reports from the Mount Vernon branch of the New York Infant Asylum: After a period of twenty-one months free from the disease a patient was attacked after a residence of twelve days. From this came other cases until within a little more than six months there were twenty-two cases with fifteen deaths. The number of cases now began to increase until for three successive months there were in each month thirty or more cases. At about the middle of the last month forty-two children whose throats contained the [Klebs-]Loeffler bacillus were selected and removed to one of the buildings, and to one-half of this number 150 units of Behring's antitoxin II. were given. No cases of diphtheria developed in either series during one month, but at the expiration of that time one of the boys who had received an injection of antitoxin was attacked by the disease. In the meanwhile the

epidemic was persisting among the other children, and about the middle of the month two hundred and twenty-four children were inoculated with the same serum, 100 to 200 units, according to age. Among these cases there appeared seven cases of diphtheria. Six weeks from the time of the last, a second general inoculation was given, and two hundred and forty-five children received the Board of Health antitoxin, 125 to 225 units. From this inoculation there was a period of complete immunity for over four and one-half weeks. The antitoxin apparently exerted no influence upon the bacillus itself. The ill-effects from the antitoxin were limited to a few cases of pronounced urticaria after both general inoculations, and a few needle abscesses after the first, consequent upon haste. Constitutional symptoms with temperature, etc., were almost *nil.*—*New York Medical Record*, 1895, No. 1276, p. 486.

Acetanilid-poisoning.

Dr. Randle C. Rosenberger reports a single case, an Italian child, sixteen days old, suffering from hemorrhage from the umbilicus. A paroxysmal cough made the hemorrhage worse. A powder of equal parts of boric acid and acetanilid was to be locally applied twice daily. Three days after the face was distinctly cyanotic, the lips, ears, finger-tips, and toes bluish, the hands and feet cold, the breathing bordering upon stertor. The powder was discontinued and $\frac{1}{300}$ grain of strychnine sulphate with ten drops of brandy in water were given four times daily. Within forty-eight hours the cyanosis had disappeared, the hands and feet were warm, the child was much brighter, and the hemorrhage had not recurred.—*The Philadelphia Polyclinic*, 1895, No. 45, p. 460.

Thyroid Feeding.

Dr. Lewis C. Bruce reports a second series of sixty cases. The majority of cases chosen for treatment were unfavorable, and all had received, without apparent benefit, the best dietetic and therapeutic treatment which the Royal Edinburgh Asylum could give. There were several most gratifying results in the shape of recoveries, where patients threatened to pass into confirmed dementia, or had remained stuporous for long periods, as in one case of two years' standing. Whether its action is due to the febrile process induced by the thyroid and the subsequent reaction to the fever, the answer is made that the actual and visible result of thyroid feeding has all the appearance of a condition induced by a toxin introduced into the blood through the medium of the mucous membrane of the stomach, and it undoubtedly produces a mild feverish condition, the action and reaction to which is often of considerable benefit to the patient. It is also a direct cerebral stimulant which may prove to be an advantageous treatment in cases whose higher cortical cells remain in an anergic condition after acute attacks of insanity. There is also strong probability that at some periods of life the administration of thyroid supplies some substance necessary to the bodily economy.—*Journal of Mental Science*, 1895, No. 139, p. 636.

Dr. Wilhelm Knoepfelmacher has made use of thyroid extract in tablet form in twenty-two cases of struma. The duration of the treatment

varied from six weeks upward. In eleven cases there was marked diminution even to complete disappearance. In five others there was considerable but not so marked improvement. In the remaining cases the treatment was without result. In the five cases in which the treatment was only partially successful, potassium iodide internally and iodine ointment externally also failed. Four patients, who were seen from three to five months after the cessation of treatment, were found to be in the same condition as at its close. The explanation being apparently that in hyperplastic struma the gland substance functionally hypertrophies, and upon the administration of the extract this hypertrophy retrogrades, provided that secondary changes have not supervened.—*Wiener klinische Wochenschrift*, 1895, No. 41, S. 715.

The Treatment of Zona.

M. Albert Robin commences with the administration of a saline purgative, preferably sodium sulphate. For the eruption it is essential that it be kept dry. The application recommended, which will also relieve the pain, is composed of powdered starch, 60; zinc oxide, 15 to 20; powdered camphor, 1 to 3; and finely powdered opium, 1 part. In old people the eruption should be closely watched to prevent ulceration. The neuralgia which precedes and accompanies the eruption is treated by four pills daily, each containing one-sixth of a grain of extract of datura stramonium and extract of gelsemium, and one-twelfth of a grain of extract of belladonna. If these pills should fail antipyrin is to be substituted. For the neuralgia consecutive to the eruption subcutaneous injections of antipyrin are employed, or those of sodium glycero-phosphate.—*Bulletin général de Thérapeutique*, 1895, 40 liv., p. 358.

The Treatment of Lumbago.

M. Albert Robin mentions the various local applications with friction which have been used from time immemorial, revulsives, counter-irritants, and wet-cups. Of the applications, massage of the joints, electricity, particularly for the secondary muscular atrophy, and methyl-chloride for the acute stage, are especially mentioned. For the internal treatment jaborandi is most strongly recommended. As contra-indications to its use should be cited disturbances in the cardiac rhythm, and it should be omitted if epistaxis or the quantity of urine does not reach the normal amount after diaphoresis. The method of preparation is as follows: Sixty grains of the leaves are macerated for twelve to twenty-four hours in two and one-half drachms of alcohol. Upon this mixture is poured one and one-half ounces of boiling water, which is infused for twenty-four minutes and then filtered. The filtrate is taken hot, as it is prepared, in the morning, fasting. During the perspiration the patient should avoid swallowing the saliva, which may give rise to nausea or even to vomiting, and for the thirst he should drink only a small quantity of warm liquids, diluted coffee, in order to avoid the vomiting which follows the immoderate ingestion of cold liquids or the swallowing of a certain quantity of saliva. There are instances when a single dose of the remedy will cure the disease. In case it is necessary to repeat the treatment, it is well to have a day of intermission between the doses.

The patient should be kept warm, confined to his room or even in bed. In case that this remedy is contraindicated, sodium glycero-phosphate, five to seven grains, hypodermatically can be substituted. In certain cases when the articulations are affected sodium salicylate may be of use, but it is not so valuable as is jaborandi.—*Bulletin général de Thérapeutique*, 1895, 36 liv., p. 241.

MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D.,

PROFESSOR OF MEDICINE IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND;

AND

GEORGE DOCK, M.D.,

PROFESSOR OF MEDICINE IN THE UNIVERSITY OF MICHIGAN.

Alcoholic Myocarditis.

Aufrecht (*Deutsches Archiv für klin. Med.*, Bd. liv. p. 615) calls attention to a class of cases not hitherto recognized. The disease usually occurs in men between the ages of twenty-five and fifty, but in one case appeared in a man nineteen years old. Brewers and inn-keepers form a large proportion of cases; women are rarely affected. All the patients admit excessive use of alcoholics. That all who indulge in the same way are not affected may be due to mode of life, to exercise, temporary periods of abstinence, or other unknown causes. The disease begins gradually. Most patients in the beginning are well nourished. The first symptom is dyspnœa, which may be noticed in talking; in more advanced stages on climbing stairs. A feeling of pressure in the heart region is not uncommon. The patients are usually able to continue their business, especially when it does not involve severe bodily labor. On account of the course of the disease the heart—the organ first affected—is rarely examined in the earliest stages. Cases examined at such times show an enlargement of the cardiac dulness, rarely a murmur. Aufrecht considers the lesion in the heart to be at first dilatation from the effect of the alcohol on the muscle; this is followed by hypertrophy of the muscular fibres and their nuclei, increase of connective tissue, thickening of the smaller arteries with increase of nuclei in their walls, and, finally, fragmentation of the muscle-fibre. For these lesions Aufrecht prefers the term at the head of this article. At an early period of the disease the liver is enlarged, perhaps on account of the dilatation of the heart, though the author thinks more probably from inflammatory changes due to alcohol. Later, cirrhosis occurs, either atrophic or hypertrophic; in some cases there is peri-hepatitis. Congestion of the kidneys also occurs, with temporary albuminuria. In one case uræmic mania with albuminuria gave the first indication of the kidney affection, the attack being brought on by a wine-dinner. In another case there was temporary diabetes. Alcoholic myocarditis was at

first mistaken for nephritis, and it was only by prolonged observation of favorable cases that Aufrecht came to the conclusions indicated in this paper. According to him not beer alone, but other alcoholics, even wines, are dangerous.

Fatal Varicella.

Cassell (*Archiv für Kinderheilkunde*, Bd. xvii. p. 371) makes an addition to our knowledge of the dangerous complications of chicken-pox. Five out of twelve cases treated in his polyclinic had albuminuria or nephritis. All the patients were from the poorer classes, between the ages of five months and three-and-a-half years. The albumin appeared after desiccation, not earlier than the fourth or fifth day. Three of the patients died, albuminuria continuing to the last. In the other cases albuminuria was of brief duration. In one of the fatal cases, a previously healthy child treated under unfavorable hygienic conditions, the vesicles became gangrenous and ulcerated.

The Causes of Cardiac Weakness in Infectious Diseases.

Romberg has endeavored to discover whether certain cases of heart-failure are due to an affection of the cardiac muscle or of the vasomotors. As fall of blood-pressure occurs in either case, the estimation of the pressure alone throws no light on the question. By abdominal massage, or by compression of the descending aorta above the diaphragm, the work of the heart is increased. If the heart-muscle is sufficient the pressure then rises. On the other hand, certain vascular reflexes after irritating the skin or mucous membranes increase the blood-pressure, but only when both heart-muscle and vasomotors are competent. By taking advantage of these facts it is possible to ascertain whether, in an acute infection, either heart or vasomotors, or both, are affected. It was found that the blue-pus bacillus and the pneumococcus of Fränkel paralyze the vasomotor centres in the medulla; the peripheral vasomotors and Goltz's centre remain intact. The pneumococcus does not affect the heart, which retains its efficiency to the last, even for some time after vasomotor paralysis. In the human subject weak heart is dangerous, because, if the disease in the lung is extensive, the right heart is overburdened, or, in other cases, because the heart cannot compensate for the fall of pressure due to vasomotor paralysis. (From the sixty-seventh meeting of the German Naturalists and Physicians. *Centralblatt für innere Med.*, 1895, No. 40.)

Changes in the Spinal Cord in Chronic Diseases.

At the recent meeting of German Naturalists and Physicians (*Centralblatt für innere Med.*, 1895, No. 40) Lubarsch called attention to the occurrence of degeneration in the posterior roots and posterior columns of the spinal cord in cancer of the stomach. He had found the degeneration in six cases. Lubarsch attributed the changes not to anæmia, nor to the action of specific cancer toxins, but to the effects of toxic substances formed in the gastro-intestinal contents.

Schultze spoke of similar changes occurring in a number of chronic diseases, such as tuberculosis. The relations are not clear; perhaps the condi-

tion is simply due to malnutrition. The localization in the posterior columns has not been explained, except on the ground that those columns are predisposed to degeneration.

Erosion of the Stomach.

Einhorn (*Berliner klin. Wochenschrift*, 1895, Nos. 20 and 21) has observed seven cases in which small bits of gastric mucous membrane were constantly present in the water returned in the lavage of the empty stomach. Mechanical abrasion by the tube could be excluded. In one case the water was tinged with blood. In one case there was increase, in the others decrease of hydrochloric acid. Symptomatically the cases presented pain in the stomach, lasting one or two hours after meals, emaciation, and a feeling of weakness most marked after eating. The course was chronic, but interrupted by periods of health. Symptoms of ulcer never appeared, so that the idea that erosions, such as were undoubtedly present in these cases, represent the beginning of round ulcer, is not borne out by Einhorn's observations. The author looks on the process as due to chronic catarrhal inflammation. Treatment consisted in the use of the stomach-douche with a spray attachment, in which ½ per cent. solution of silver nitrate was used. Direct galvanization, nux vomica, condurango, and iron were also used.

Indurative Mediastino-pericarditis.

Thomas Harris (reprint from the *Medical Chronicle*, 1894–95) has tabulated and analyzed the histories of cases of chronic inflammation of the mediastinum and pericardium in which post-mortem examinations were made, including three cases observed by himself. He was able to find records of twenty-two cases of chronic mediastino-pericarditis and three cases of non-suppurative inflammation of the mediastinum. Of the former, two varieties can be distinguished. In one there is adhesive pericarditis and marked increase of fibrous tissue in the mediastinum. At the same time there is adhesion of the pericardium externally to neighboring tissues, "a condition which is accurately termed indurative mediastino-pericarditis." In the other form there is adhesive pericarditis, with thickening of the sac and adhesion to surrounding parts, but little or no general mediastinitis. This is sometimes called pericarditis interna and externa. The two varieties have been confused by authors—a fact of minor importance, since the distinction can rarely be made during life. Of the twenty-two cases, nine were under and thirteen over eighteen years of age, only two were over thirty. The youngest of the three cases of chronic mediastinitis was thirty-seven years of age. There were seventeen males, five females. Exciting causes could not be accurately determined. In many cases the onset was insidious. Traumatism was rarely alleged as a cause. Of the physical signs noted the most frequent are dyspnœa, venous engorgement, cyanosis, enlargement of the heart and liver (not usually of the spleen), ascites or anasarca, pulsus paradoxus, and inspiratory swelling of the cervical veins. These are not always present in every case. The posture described by Jaccoud as characteristic, in which the patient sits bending forward, is not generally assumed. Dyspnœa increases as the disease advances.

The author considers the causes of various symptoms of the disease. The pulsus paradoxus, formerly considered pathognomonic, is seen occasionally when the mediastinum is not affected, as in different forms of pericarditis, large pleural effusions, great cardiac weakness, convalescence from long-standing febrile affections, mitral regurgitation with dilatation, stenosis of the air-passages, or even in health; and mediastino-pericarditis may exist without pulsus paradoxus. The duration of the disease varies from a few months to several years. The cause of death is usually gradual dilatation of the heart, often complicated by pneumonia, pleurisy, or tuberculosis.

The cases of the author are illustrated by figures, showing the physical signs and reproductions of the post-mortem appearances. A useful bibliography adds to the value of the work.

The Knee-jerk in Psychiatry.

At the last meeting of the Verein der deutschen Irrenärzte (*Neurologisches Centralblatt*, 1895, No. 19, p. 880) **Cramer** reported some results of the study of 2384 cases, from which the following conclusions, among others, were drawn: Progressive paralysis is the only form of insanity with a definite relation of the knee-jerk in a certain proportion of cases. Absence of the knee-jerk in cases of insanity in which alcoholism, exhausting excitement, and severe lesions of the nervous system can be excluded should arouse suspicion of general paralysis, and is therefore a symptom pointing to bad prognosis. In the convalescence of mania, or in chronic mania, or in the acute forms of paranoia, and in alchoholic psychoses absence of the knee-jerk is only of bad prognosis when signs of extreme collapse are present. Increased knee-jerk is only of bad prognosis when combined with advanced idiocy, or symptoms of general paralysis. Increased knee-jerk is only rarely important in differential diagnosis. In the course of chronic paranoia increase of the knee-jerk with other symptoms points to an exacerbation. Neurasthenia seems always to be accompanied by increased knee-reflex. Cases of general paralysis with absent knee-jerk seem to have a longer course with more marked depression, and with rare periods of excitation. Absence of the knee-jerk after epileptic attacks allows the exclusion of simulation.

Smith called attention to the great value of Sommer's instrument for registering the knee-jerk.

Mendel said that he had failed to get the knee-jerk in only one case of functional psychosis. In this case, one of apparently recent mania, the patient recovered, but in two years proved to be paretic. Mendel prefers the terms "strong" and "weak" to "increased" or "decreased," as applied to the knee-jerk.

Non-perforative Pneumothorax.

Levy reports "the first accurately observed case of so-called spontaneous pneumothorax." A previous healthy man of forty-eight years was aspirated five times in the course of two months for pleurisy, with an extensive serous exudate. A week after the last puncture signs of pneumothorax developed. Aspiration and costal resection were followed by death in one month. Au-

topsy showed an old caseous apical focus; miliary tuberculosis; fibrinous pleurisy; no signs of perforation.

Bacteriological examination of the serous exudate showed in anaërobic cultures a short, thick, non-motile bacillus, which produced gas. Cultures of this killed guinea-pigs, with gaseous exudate at the point of inoculation. The same bacillus was found by the author in a case of parametric gas-abscess, and was cultivated from four cases of gas-abscess by E. Fränkel. (*Arch. für exper. Path. und Pharmakol.*, Bd. xxxv. H. 4 und 5.)

Analgesia of the Ulnar Nerve.

Biernacki found, some time ago, that the unpleasant sensation produced in healthy persons by pressure on the trunk of the ulnar nerve in the ulnar groove is often absent in tabes.

Cramer examined the matter in cases of mental disease, and found that in the non-paralytic insane the reaction was more or less distinctly present in three-fourths of all cases, but that in thirty-nine out of fifty-one paralytics, or 76 per cent., there was ulnar analgesia on both sides.

Snell has recently examined one hundred cases, including twenty-five paralytics, but without such striking results as those of Cramer. He found that as regards the reaction patients may be classified as follows: 1. Those with normal sensibility to pressure in the ulnar; 2, those with none; 3, an intermediate class in which the reaction is weak, or different in the two arms. In twenty-five paralytics the results were: normal in one, weak in ten, absent in fourteen. Among seventy-five non-paralytics the reaction was preserved in twenty-five, weak in thirty-nine, absent in eleven. Further examination showed that ulnar analgesia is not related to paralysis except inasmuch as severe lesions of sensibility may be present. In non-paralytics, as a rule, analgesia of the ulnar was combined with other severe disturbances of sensibility. That ulnar analgesia is more frequent in paralysis than in other mental diseases appears to be demonstrated by the observations so far published. (*Berliner klin. Wochenschrift*, 1895, No. 42.)

The Relation Between Tabes, General Paresis, and Spinal Syphilis.

Nageotte has recently studied the pathology of several cases of general paresis, tabes, and spinal syphilis, with especial reference to the character of the lesions found.

He finds in all cases certain inflammatory changes of a chronic character, and is inclined to think that the three separate clinical pictures are only the result of the preponderance of the inflammatory process in certain locations, the nature of the process being the same in all three diseases.

He dismisses the subject with the following conclusions:

1. There exists in tabes, general paresis, and syphilitic myelitis a diffuse inflammatory process which involves the whole cord. This lesion merits the name of "vascular" or "connective" on account of the tissues it seems to attack in the first place. It consists essentially in a round-cell infiltration, which invades the pia mater, the arachnoid, and the capillaries of

the spinal cord, and which has a peculiar predilection for the coats of the superficial veins. It causes secondary alterations in the essential elements of the cord. It appears to be constant if one employs suitable elective nuclear dyes for its detection.

2. The lesions of the central cortex—causes of general paresis, those of the radicular nerves; causes of tabes, the localized foci of syhilitic myelitis are only exaggerations of this diffuse lesion in certain points of election, the determination of these points of election being due to factors still imperfectly understood.

3. The process presents a very characteristic aspect which seems to make it a distinct entity, though one cannot definitely affirm that the same causes always give rise to it. In all cases, however, it is certain that from a clinical standpoint the great majority of cases have a direct connection with syphilis.—*Archives de Neurologie*, October, 1895.

Pyloric Obstruction from Gall-stones.

Galliard has recently reviewed this subject in an interesting manner. He comments on the rarity of the condition, and the still greater rarity of its appearance at the autopsy table.

He cites several interesting cases where facetted gall-stones had been vomited by the patient, or even passed by way of a stomach tube.

The mechanism of the obstruction would seem to be variable. In one class of cases the stone or stones ulcerate into the stomach cavity, adhesions having first formed, and then get into and occlude the pylorus.

Again, when adhesions have taken place between the pylorus and the gall-bladder, the former becomes a fixed point, and, as it can no longer recede before a gall-bladder distended with stones, the pyloric lumen can be occluded by their pressure. In another class of cases adhesions form between the gall-bladder and the stomach and by their innate power of contraction occlude the pylorus. The occlusion may at first be only partial, but, the pylorus being fixed, the gradually distending stomach drags more and more upon it and in this manner increases the occlusion.

The condition would seem to be difficult to diagnose, except in those cases where gall-stones are vomited or brought up by the stomach tube.—*La Presse Médicale*, October 5, 1895.

The Liver and Bacterial Poisons.

Teissier thinks that just as lymph glands may destroy or elaborate certain products brought to them, so the liver in like manner may elaborate certain poisons brought to it. This view, he states, is upheld by both clinical and experimental evidence. The author and M. Guinard have carried on a series of experiments in relation to the difference in rapidity of action of bacillary poisons when injected on the one hand into the jugular and on the other hand into the portal vein.

The animals inoculated into the portal vein died much more promptly than those inoculated into the jugular, though with similar symptoms.

The result, Teissier thinks, is due to the fact that the poison finds conditions for multiplication in the liver which are not present in the other

organs. These conditions he regards as of a fermentative nature, the fermentation leading to the production of an intensely powerful toxine.

This action of the liver, he thinks, may explain certain clinical facts, such as sudden intoxication following the passage of a choleraic stool, the poison in this case reaching the liver by way of the intestine.

The conclusions he comes to are directly opposed to those of Roger, who propounded the destructive action of the liver on poisons.—*La Presse Médicale*, August 14, 1895.

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D.,

PROFESSOR OF CLINICAL SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE UNIVERSITY AND GERMAN HOSPITALS;

ASSISTED BY

ALFRED C. WOOD, M.D., INSTRUCTOR IN CLINICAL SURGERY, UNIVERSITY OF PENNSYLVANIA; ASSISTANT SURGEON, UNIVERSITY HOSPITAL.

AND

C. L. LEONARD, M.D., ASSISTANT INSTRUCTOR IN CLINICAL SURGERY IN THE UNIVERSITY OF PENNSYLVANIA.

THE TREATMENT OF MALIGNANT TUMORS WITH ERYSIPELAS SERUM.

IN an article in the *Münchener medicinische Wochenschrift*, 1895, No. 36, CZERNY discusses this subject and relates his experience therewith. He states that accidental erysipelas sometimes has no effect on cancer, or may even hasten its course. He refers to a case of inoperable recurrent cancer of the breast, however, in a patient who insisted on the removal of the growth by operation. He concluded to remove the tumor down to the ribs. The intercostal spaces were found infiltrated with the cancer. An open wound was left as large as the hand. During the convalescence a severe attack of erysipelas brought the patient to the border of the grave. She recovered, the wound healed in eight weeks, and the cancer masses disappeared. She remained well for two years, when she died of a subacute inflammation of the lungs. At the autopsy there was no sign of cancer at the seat of the former trouble, but the lung contained cancer nodules.

He relates the case of another woman operated upon for carcinoma of the breast. The axilla was cleaned out in the most careful manner. She came to Czerny later with numerous subcutaneous nodules, hard, and of various sizes. The involved skin and fatty tissue beneath were removed. An attack of erysipelas developed, being favored by the tension of the sutures. The wound healed without trouble, and while previously there had been two recurrences at intervals of half a year, she remained well at the end of six years.

In Germany, Friedrich, of Leipzig, and Kocher have made interesting observations on Coley's method, but it appears without success.

Czerny refers to the case of a woman, who, during pregnancy, developed a

tumor of the right parotid. The tumor increased rapidly in size and broke into the external auditory canal, causing paralysis of the facial nerve and all its branches. The external ear was also involved. As extirpations were out of the question, injections of erysipelas toxin were begun. The local and general conditions improved so much that the patient wanted to go home. The microscope showed the masses growing in the auditory canal to be round-celled sarcomata with some epithelial cells and pearly bodies. The author remarks that even if this tumor entirely disappeared it would not prove anything, as it began during pregnancy, and it is well known that such growths either partly or entirely disappear after parturition in certain cases.

Another case was that of Mr. P., aged twenty-five years, with an angio-sarcoma of the left lateral wall of the pharynx. It was first curetted. This was followed by the radical operation for the removal of the growth, and another operation later for the removal of enlarged glands in the neck. Injections were begun for local recurrence. They were always followed by fever, pain, local swelling, and herpes labialis. The tumor visibly decreased in size, and further glandular involvement did not occur up to the time of the report.

Typical carcinomata of the upper jaw, lower jaw, rectum, and mamma were subjected to this treatment, but without result up to the time of making the report. In one case of carcinoma of both upper jaws there was some decrease in size, softening, and improvement in swallowing. Although most of such cases are incurable, the patients should be given the chance offered by this remedy, as some tumors seem to be favorably influenced by its use.

EMMERICH and SCHOLL report six cases in the *Deutsche medicinische Wochenschrift*, 1895, No. 17, subjected to the erysipelas serum treatment:

CASE I.—A woman, aged fifty-four years. After two daily injections of 0.5 c.cm. of the serum into the pigeon-egg-sized tumor, it decreased one-half in size, and the skin that had been tense became wrinkled. On the third day the tumor had entirely disappeared after the injection of 2 c.cm. in all. Also injection into a hard subclavicular infiltration had caused considerable decrease in size. A tumor the size of a hen's egg in the axilla had disappeared in three weeks. At the end of four weeks the patient left the hospital temporarily cured.

CASE II.—A very similar recurrent carcinoma of the mamma was considerably reduced in size by injections of 0.3 to 0.5 c.cm. of the serum. The cure was interrupted, however, by other causes.

CASE III.—A sloughing carcinoma of the breast, with metastases in lungs and pleura, subjected to this treatment resulted in decreasing the size of the tumor by two-thirds.

CASE IV.—A recurrent carcinoma the size of a nut on the inner side of the arm disappeared after the use of 20 c.cm. of the serum.

CASE V.—A woman, aged thirty-four years, had a large carcinoma of the mamma and a gland in the axilla as large as a goose-egg. After sixteen days' treatment the circumference of the formerly rapidly growing tumor was reduced by eight c.cm., the gland in the axilla decreased at least one-half, and the hard, formerly carcinomatous tissues got soft.

CASE VI.—Cancroid in a woman aged sixty-five years, situated at the outer angle of the eye; 0.5 to 2.0 c.cm. of the serum were administered at a time,

with frequent interruptions, and the authors noted a decadence in the carcinomatous tissue and the partial formation of scars.

The authors also observed softening and decrease in the size of a six-year-old sarcoma of the shoulder, of stony hardness, after three weeks of the serum treatment.

Anal Fissure or Ulcer.

Harrison Cripps, in a lecture on this subject (*British Medical Journal*, 1895, No. 1803), advises that a patient with rectal or anal trouble be asked the following questions before making an examination:

1. How frequently do you go to the closet?
2. Do you pass any discharge from the bowel, and what does it look like?
3. Do you have any pain, and does it come on immediately after passing a motion?
4. Does any part of the body come down at stool?
5. Do you pass any blood?
6. Is the pan ever sprinkled or splashed with blood as if it had come out in a fine jet?

If the patient has frequent calls to the closet extending over some months, and if the trouble originates in the rectum, either ulcerations, cancer, or stricture will almost surely be found to be present. On the other hand, if the patient is constipated or has but one motion daily, we may be sure none of these diseases exist. The error is commonly made of supposing that constipation is a symptom of stricture of the rectum, whereas diarrhœa is nearly always complained of. If a discharge is present it is necessary to ascertain whether this comes from the interior of the bowel on going to the closet, or whether it comes from the outside as evidenced by stains on the linen. If from the inside and clear like the white of an egg, it may be mucus from internal prolapse or piles. If the quantity is considerable, a villous growth or polypus may be suspected. If the discharge is purulent or has a coffee-ground appearance, there is possibly internal ulceration, fibrous stricture, or cancer present. Discharge originating external to the bowel and staining the linen generally comes from a fistula. When part of the body comes down at stool, it will be either prolapse, internal piles, or hemorrhoids. Bleeding is common to almost all forms of rectal disorder, but one form is almost characteristic. If, during stool, the pan is sprinkled with blood, whatever else may be the matter, internal piles are almost certainly present.

Any disease situated about the anus or the last inch of the rectum gives rise to pain, whereas extensive ulceration or cancer situated above the internal sphincter may be almost painless. The pain of anal fissure is, however, almost diagnostic. It comes on during or soon after a motion of the bowels and continues for some time, gradually subsiding in the course of from a few minutes to several hours, when the patient is free from pain until the next evacuation. The pain is frequently of a burning character, and may be very severe. It is stated that in nine cases out of ten the ulcer will be found in the middle line, posteriorly.

The treatment of anal fissure may be either palliative or operative. If the case is of very recent origin, if muscular fibres are not exposed, and if there

is no undermined muco-cutaneous surface or sinus, a cure may be effected by simple remedies. The motions should be kept soft by suitable laxatives, the anus should be gently washed with soap and water night and morning, and on no account should paper be used in the closet, the part being cleansed with a sponge or cotton and water. A soothing ointment may be applied five minutes before a motion, and an astringent ointment at night. If this treatment fails, or if the case is of a more aggravated type, operative treatment becomes necessary. This Cripps describes as follows: After the usual preparation, the patient is etherized and placed in the lithotomy position. The sphincter is gently dilated and the ulcer examined with a fine probe to see if any fistulous tract exists, and the extent of the undermining of the edges. If a sinus is present it is opened in the usual manner. A speculum is next introduced in the rectum and the base of the ulcer divided. The incision should commence half an inch above the ulcer on the mucous surface and extend an equal distance on the cutaneous surface. Its depth should be sufficient to partly divide the external sphincter. A strip is then cut from either edge of the incision by scissors. The usual dressing is applied. It is recommended to keep the patient in bed two weeks; after getting about, walking will be less objectional than sitting until the wound is healed.

On Synovitis and Suppurative Arthritis Occurring as Complications of Erysipelas.

Gamgee calls attention in the *Birmingham Medical Review*, 1895, vol. xxxviii. No. 205, to the infrequency with which these complications are referred to by most authors of English text-books. He has collected records of 817 cases of erysipelas, among which were 12 (1.46 per cent.) cases of synovitis or suppurative arthritis. Regarding the pathology of these conditions, the author could find but one reference bearing on the former, that of Schuller, who found the streptococcus of erysipelas in a case of erysipelatous hydrarthrosis. Fehleisen and Hajek hold that the streptococcus erysipelatosis is incapable of causing suppuration, which when it occurs is due, they claim, to the streptococcus pyogenes. On the other hand, a number of observers have found the erysipelas coccus in suppurating inflammation of the joints, which have been produced experimentally, indeed, in animals by injections of pure cultures. The cocci reach the joints by direct extension, when the area of erysipelas is in the vicinity of the affected joint, or by metastasis when the joint lesion occurs at a point remote from the seat of primary infection. The joint complications may arise at any time during the course of the attack of erysipelas. In two cases of synovitis recorded by Boucher, the affection appeared on the twentieth and eighteenth days respectively. In suppurative arthritis the earlier the disease appears the more acute are its symptoms, and unless prompt and energetic treatment be instituted disorganization of the joint will speedily follow, if not even the death of the patient. The prognosis will depend on the same factors as in other cases of suppurative arthritis. The treatment recommended in synovitis is perfect rest of the joint. In suppurative, free incisions and absolute fixation are advised. Amputation may become necessary.

Cœliotomy for Volvulus of the Sigmoid in a Man Aged Eighty-five Years; Intestinal Drainage; Recovery.

J. Greig Smith and Charles E. S. Flemming report in the *British Medical Journal*, 1895, No. 1803, the case of a man, aged eighty-five years, who presented the usual symptoms of volvulus. There had been complete obstruction for a week. After making an incision an enormously distended sigmoid could be detected by the fingers. A fold was pinched up and brought through the wound and incised, when enormous quantities of gas escaped. The gut was found to have made one complete twist, perhaps a little more. After reducing the twist, as the abdomen remained greatly distended, it was decided to fix and drain the bowel. This was accomplished by thrusting a piece of rubber-tubing of the diameter of a crow-quill through the incision made to relieve the distention, by stretching over a probe. It was retained by passing a safety pin through the serous and muscular of the bowel and through the wall of the tube. Secondary sutures were introduced.

On the third day the abdomen was nearly flat and the tube was removed. The wound in the bowel was closed by Dupuytren's suture, and the parietal wound closed. The patient did well from this time on, excepting an attack of pain and collapse on the eighth day.

Mr. Smith says: "Intestinal drainage as an accessory is scarcely inferior to removal of the cause of the obstruction in many cases as a means of getting the patient well. Properly managed, it can scarcely do harm and adds nothing to the operative risk, while its benefits in the reduction of mortality are very conspicuous." His experience now covers one hundred cases.

A Modification of the Operation of Pyloroplasty.

Robson describes (*British Medical Journal*, 1895, No. 1803) two cases, and refers to a third, in which he performed the operation of pyloroplasty for stricture of the pylorus. All were successful. A longitudinal incision was made through the strictured portion, but instead of suturing this transversely, as is done in the Heineke operation, he introduced a decalcified hollow bone bobbin. Two continuous sutures were used to close the wound transversely —one through the mucous coat and one through the serous membrane. The bone-tube secures an immediate and thoroughly patent channel and affords protection to the line of sutures for from twenty-four to forty-eight hours, when union should be well established.

Resection of the Hip for Coxalgia.

Lambatte concludes an extensive study of this subject with the following summary (*Journal de Médecine de Chirurgie et de Pharmacologie*, 1895, Tome iv. Fasc. 3):

1. Conservative treatment must be reserved for the first stage of coxalgia.
2. Surgical intervention in tuberculosis of the hip joint is indicated as soon as pus has formed in the articulation.
3. In coxalgia without suppuration surgical intervention is indicated if the pain or the deformity resists continuous extension.

4. The extension of local lesions does not form a contra-indication to operation.

5. In coxo-tuberculosis, total resection should always be practised.

6. Total disarticulation of the thigh should not be resorted to at the onset of the disease.

7. The best method of performing total resection is by the longitudinal external incision.

8. Vertical division of the trochanter should by preference form the first step of the resection.

9. In children the integrity of the cartilaginous trochanter must always be preserved.

10. The gravity of resection, practised at the beginning of the suppuration, is very slight.

11. The resection is less grave the more radical the operation.

12. In order to secure complete and definite cicatrization, it is necessary to remove all tuberculous tissue.

13. In suppurating coxalgia resection gives better results than conservative treatment.

14. The movable new joint that follows resection is superior to ankylosis.

15. Extensive resections of the acetabulum are not to be recommended from an orthopædic standpoint.

16. In children subtrochanteric resection with preservation of the cartilage of the trochanter gives results identical with simple cervical section.

On Gall-stones.

Morrison (*Annals of Surgery*, August, 1895) records a series of cases, including nine cases already reported, in which the operation for gall-stone was performed in accordance with the method he proposed. He endeavors to show that the secret of success in such operations is the drainage of a pouch of peritoneum, first described by him, which exists beneath the right lobe of the liver, and which is shut off by natural barriers from the general peritoneal cavity. He calls attention to other points that have interested him, and especially to the importance of a careful study of the anatomy of the right hypochondrium.

In his remarks on the nine cases now reported the author emphasizes the following conclusions:

Gall-stones are formed in the great majority of cases in the gall-bladder. Mucus seems to be essential to their formation, and this is only secreted by the gall-bladder and the larger ducts. The occurrence of stones in the small ducts does not prove their formation there; it is not difficult to believe that they have been carried there by a back flow of bile.

In addition to the ordinary symptomatology, he lays great stress upon the following facts:

When the gall-bladder is distended after the first acute attack, and jaundice and pain are absent, a stone has completely blocked the mouth of the gall-bladder or cystic duct.

Attacks of severe pain in the epigastrium and right hypochondrium, accompanied by vomiting and shivering, and followed by sweating, complete

relief and transient jaundice, are due to the passage of a gall-stone from the gall-bladder through the ducts into the duodenum.

If the relief after the attack is incomplete, the jaundice more or less persistent, and the patient attacked with ague-like paroxysms, generally with, but perhaps without pain, each attack being followed by a temporary increase of jaundice, a stone is impacted in, but does not completely block, the common duct.

Persistent jaundice and a distended gall-bladder, but without severe pain are due to a complete obstruction of the common duct, arising usually from malignant disease in the neighborhood.

Like the urinary bladder, the gall-bladder will become contracted and hypertrophied when dealing with a partial obstruction, and, like it, will dilate painlessly when all its efforts to overcome the obstruction are futile.

In regard to operation, the author concludes that the exposure of and manipulation of the pouch described causes less shock than an ordinary abdominal section, for the small intestine need neither be seen nor handled. The pouch can be efficiently drained through an opening in the parietes near the lower end of the kidney. A transverse is better than a vertical incision in operating for gall-stones. It gives better access and is less liable to be followed by ventral hernia.

The suturing of the gall-bladder to the parietes should be reserved for special cases, as experience shows it is liable to produce a biliary fistula. The gall-bladder may safely be allowed to empty into the pouch described if it is properly drained.

The pouch should be properly drained (*a*) when the gall-bladder is distended; the opening in the latter should be closed by sutures, the viscus returned into the abdominal cavity and the drain left in until the certainty of its successful closure is complete; (*b*) when the gall-bladder is shrunken and there is difficulty in closing the incision, it may be returned without suturing; (*c*) when a stone is impacted in the cystic duct, it may be excised by cutting down on it through the duct, or it may be crushed when small and soft, after which the gall-bladder must be sutured to the parietes to allow of the escape of fragments, or if the stone is hard and inaccessible the gall-bladder should be excised, the stone removed, and the cystic duct ligatured.

The author believes that considering the safety and certainty with which a stone can be removed by incision from the only portion of the duct in which it could be crushed, crushing with its risks and uncertainties should be abandoned.

If the usual operation is followed by the fresh formation of gall-stones in even a small percentage of cases, resection of the gall-bladder will have to be made the rule.

An Operation on a Tumor of the Spinal Cord.

Kummell (*Beilage zum Centralbl. für Chir.*, 1895, No. 27) reports a very interesting successful operation for a tumor of the spinal cord. The patient was a man of good family history, forty-seven years of age, who had, since 1889, complained of weakness and pain in the limbs, which gradually increased and resisted all treatment. In May, 1893, a tumor was felt per

rectum on the sacrum; it proved to be a sarcoma, which was removed successfully, the patient recovering entirely and resuming his work.

He remained perfectly free from pain until the next year, when he began to have pain beneath the shoulder-blades. As it gradually increased the patient began to experience weakness of the legs and gradual loss of sensation, and by the 6th of November there was complete paraplegia, the patient being unable to move foot or toe. The anæsthesia reached to the seventh thoracic vertebra on the right and to the third on the left side; above this was an area of hyperæsthesia.

The history of the former tumor made it certain that here was a similar tumor of the spinal canal. The development of the disease and pain upon the left side made it evident that the tumor lay on that side and compressed the cord. The line of demarcation between the anæsthetic and hyperæsthetic zones at the third thoracic vertebra pointed to the position of the tumor there. An operation was decided upon, and the incision at this point disclosed a roughening of the third vertebra externally. After the spinous processes and arches of the third, fourth, and fifth thoracic vertebræ were removed a crumbling, profusely-bleeding tumor presented itself; the tumor was removed with a sharp spoon, and the bleeding stopped by pressure. It was then seen that the spinal cord was compressed at the point where the tumor had existed, while above and below it was normal in size. The color was dark-red and markedly cyanotic. The tumor was easily separated from the dura, to which it was not attached. The vertebræ were partially destroyed by the pressure of the tumor. It was of interest to note that the cord, during the time required for the completion of the operation, rapidly regained its normal size, losing the bluish rose-color and being distinguishable from the normal part only by the inflammatory color remaining in it. The cavity was packed with a strip of iodoform gauze that led out through the soft parts, to the surface, which were sutured. The operation occupied a little over half an hour. The patient made a good operative recovery. The pain in the wound was very slight; reflex convulsions began on the following day in both limbs. Dressings were difficult on account of the helplessness of the patient, and the wound did not heal rapidly. The fourteenth day after operation there were no symptoms of decrease in the paralytic symptoms, the only change was an increase in the convulsions of the lower extremities.

Sixteen days after the operation the patient could move the great toe of each foot, and the next day the second and third toes, though the movement was very slight. This was the only improvement for a week, when suddenly the patient could move both feet, first the right and then the left. Other muscle groups rapidly followed, until a month and one-half after operation the patient could raise the legs in bed. Sensibility improved step by step with mobility, and two months after the operation the patient could stand, and three months after he could walk with the help of a cane and the arm of an assistant. The patient continued to improve, and could at this writing walk with the aid of a cane long distances, and could go up and down stairs unassisted. The patient has, however, incontinence of urine, and is obliged to carry a receptacle and use a catheter. There also remains some difficulty in defecation. The tumor was a sarcoma about the size of a small apple.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

GEORGE A. BERRY, M.B., F.R.C.S. EDIN.,

OPHTHALMIC SURGEON, EDINBURGH ROYAL INFIRMARY;

AND

EDWARD JACKSON, A.M., M.D.,

PROFESSOR OF DISEASES OF THE EYE IN THE PHILADELPHIA POLYCLINIC; SURGEON TO WILLS EYE HOSPITAL, ETC.

PARENCHYMATOUS CLOUDING OF THE CORNEA FOLLOWING LIGHTNING-STROKE.

R. DENIG (Würzburg) reports (*Münchener med. Wochenschr.*, 42 Jahrg., No. 34) the case of a girl, twelve years old, knocked down and rendered unconscious by lightning-stroke, who was brought on the eighth day with rather dense parenchymatous clouding of the cornea, pericorneal injection, slight œdema of the lids, especially the upper, and severe blepharospasm. Both eyes were affected. Except the eyes there was no mark or injury. Consciousness returned in about an hour after injury. The lids were then greatly swollen, and she could not open them without assistance, and complained of clouded and impaired sight. The œdema of the lids first disappeared, and in the course of about sixteen days the corneal opacity cleared up, vision became normal, and nothing remained of the injury. The case is peculiar for the absence of changes in the lens, which are the more common effect of lightning-stroke. Denig ascribes the clouding of the cornea to physico-chemical changes produced in its substance by the electricity, similar to those supposed to cause the more common and permanent opacity of the lens.

CONDITION OF THE PUPIL FOLLOWING CATARACT EXTRACTION.

T. B. SCHNEIDEMAN (Philadelphia) has observed (*Ophthalmic Review*, vol. xiv. No. 165) that usually after cataract extraction the upper part of the pupil is the clearer part, and that if this clearer field were situated lower in the pupil it would often obviate the necessity of a secondary operation. He thinks this location of the clearer space is due to the fact that this part of the capsule is more thoroughly lacerated and cleansed of cortical contents by the situation of the primary capsular incision, and the mechanical action of the upward passing lens during its delivery.

To secure an area of clearness more centrally situated, he has made the first incision in the capsule horizontally, and rather below the centre, after which the cystotome was laid aside and the upper flap of the capsule slit vertically with a Graefe knife, or with the knife of Knapp. This, so far as it has been tried, has produced the desired result.

EPISCLERITIS PERIODICA FUGAX.

Under this name E. FUCHS (Vienna) describes (*Wiener klin. Wochenschr.*, Jahrg. viii., No. 34) a form of frequently recurrent inflammation, attacking

especially the conjunctiva and episcleral tissue. It differs from acute catarrh of the conjunctiva by the absence of secretion and its limitation to the bulbar conjunctiva, and sometimes to a single quadrant of the eyeball. From ordinary episcleritis it differs in its rapid course, the absence of nodes, and its complete disappearance during the intervals. It consists chiefly of inflammatory œdema of the episcleral tissue, but the deeper structures may partake of the hyperæmia, causing pain on accommodation or movement of the globe, myosis from spasm of the sphincter of the pupil, or transient myopia due to spasm of the ciliary muscle. The inflammation is accompanied by pain which often precedes it, and indicates the occurrence of an attack.

The duration of the attack is commonly only a few days, only in particularly severe cases is it two weeks or over. But the attacks recur at intervals varying from one week to some months, and with considerable regularity. The duration of the disease is usually some years. Fuchs, among 23 cases, finds only 7 that have entirely recovered, and one case had lasted twenty years. The attacks may become gradually more severe or less severe.

Treatment is in most cases ineffective, although diathetic treatment and hydrotherapy sometimes reduce the severity of the attacks or lengthen the intervals between them. Quinine and sodium salicylate have each proved effective in one case, bringing about a complete and permanent cure. The disease is somewhat rare, but cases have previously been accurately described by others. Fuchs has observed it most frequently in middle-aged men, more seldom in women. His patients exhibited no marked symptoms of gout, and only one had suffered from acute rheumatism. Some presented enlarged spleen and other evidences of malaria. He thinks the affection is not angio-neurotic in character, but due to abnormal nutrition, causing a gradual accumulation of noxious substances in the system, which produces the outbreak.

Subjective Visual Sensations.

G. M. Gould (Philadelphia) urges that these have not been studied by scientific methods to the extent their importance warrants, and he proposes (*Medical News*, vol. lxvii. No. 11) for them a more definite classification and nomenclature. He classes them as: 1. *Peripheral*, originating in the globe of the eye and optic nerve, or in adjacent related organs, including muscæ, pressure phosphenes, etc. 2. *Central*, originating in the cerebral centres where optic-nerve impulses are transformed into visual sensations, as scotoma scintillans, phosphenes from occipital traumatism, etc. 3. *Combinations* of the two, which he calls periphero-central or centro-peripheral, according as they are primarily or preponderatingly peripheral or central.

To designate the different varieties of these sensations, he proposes to call all positive light sensations *phoses*, and to divide them into *peripheraphoses* and *centraphoses*, according to their origin. Absence or interruptions of light-sensations, as scotomata, shadows, whether formless or of more or less indeterminate form, he would call *aphoses;* and divide according to origin into *peripheraphoses* and *centraphoses*. Colored light-sensations would be *chromophoses*, and could be subdivided, according to the color exhibited, as *erythrophoses* when red, *cyanophoses* when blue, etc.

OBSTETRICS.

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.,

PROFESSOR OF OBSTETRICS AND DISEASES OF INFANCY IN THE PHILADELPHIA POLYCLINIC; CLINICAL PROFESSOR OF OBSTETRICS IN THE JEFFERSON MEDICAL COLLEGE; CLINICAL PROFESSOR OF DISEASES OF CHILDREN IN THE WOMAN'S MEDICAL COLLEGE; VISITING OBSTETRICIAN TO THE PHILADELPHIA HOSPITAL, ETC.

A Contribution to the Study of Sterility.

In the *Zeitschrift für Geburtshülfe und Gynäkologie*, 1895, Band xxxiii. Heft 2, Kleinwächter gives the results of his study of 648 cases of sterility and the effects of various methods of treatment. He found but 80 in which sterility could be ascribed with certainty to previous gonorrhœa. In 12 of these it was found that the husband was known to have had gonorrhœa. This gives a percentage of but 13 in which sterility in women can be ascribed to that cause. Kleinwächter believes that this estimate is too high, as his patients were of the lowest classes, in which such a cause would operate most frequently.

He found $76\frac{23}{100}$ per cent. of his cases had married before the age of twenty-one, and ascribes to this early marriage the condition of sterility. In 14 cases malformations of sexual organs were present. In 31 cases some constitutional condition on the part of the husband was the element in producing the result.

As regards treatment, electricity was tried in these cases without result. In two of these menstruation became more regular. The cervical canal was dilated in 8 patients, and in 1 conception occurred three years afterward. In 51 patients the neck of the uterus was divided, but one of these subsequently conceived. The results of the operation of dividing the neck of the uterus in Kleinwächter's cases were so poor that he is disposed to abandon this procedure in the treatment of sterility, and also dysmenorrhœa. In several cases general tonic treatment was followed by conception without interference addressed to the uterus. He sums up his cases as 648 in number, with but 8 in which sterility seemed to have been removed by appropriate treatment. In several cases patients recovered from gonorrhœal salpingitis and subsequently became pregnant. Of the 648 patients, $50\frac{77}{100}$ per cent. suffered from dysmenorrhœa. Kleinwächter holds that no relation exists between dysmenorrhœa and sterility.

Labor in Kyphotic Pelves.

Klien, in the *Archiv für Gynäkologie*, 1895, Band l. Heft 1, analyzes the reported cases of this pelvic abnormality, and from the study of his own cases reaches the following conclusions: The kyphotic pelvis is met with but

rarely in labor; on the average, 1 case in 6016. Kyphosis usually develops during childhood, from an injury to the spine, followed by caries. Lumbo-sacral kyphosis is as frequent as lumbal- and lumbo-dorsal kyphosis taken together. In but 8 per cent. does the spinal column actually project over the pelvis. The entrance to the pelvis is narrowed from side to side, and this narrowing becomes greater in the outlet of the pelvis. Both inlet and outlet are narrowed in the antero-posterior diameter. The distance between the trochanters is relatively less than in normal pelves, but not in proportion to the measurement between the tuberosities of the ischia. The anatomical *conjugata vera* is increased in length. The inclination of the pelvis to the line of the horizon is notably diminished. The nates are flattened. Thirty per cent of kyphotic pelves are also contracted in all diameters. So far as pregnancy is concerned in these cases, the conformation of the pelvis does not complicate this condition. The average age of primiparæ having this complication was twenty-eight and three-quarter years. Three-quarters of all these cases terminated by spontaneous labor, one-fourth of them prematurely. The usual position and presentation were present in 97 per cent. of cases. In one-third of all head presentations the back of the child was directed posteriorly. Face presentations are more common than in normal pelves.

The prognosis for birth in these cases depends largely upon the relationship existing between the distance between the tuberosities of the ischia and the biparietal diameter of the head. The possibility of the moulding of the head and the elasticity of the pelvic joints are also factors of importance. From 58 to 60 per cent. of the cases required assistance in labor. In cases where the forceps is used the mother is exposed to two dangers—separation of the pubic joints and injuries to the vaginal walls. The head usually enters the pelvis in an oblique diameter, not uncommonly in a transverse diameter, but never in the antero-posterior. If the head enters the pelvis obliquely or transversely, it usually descends and rotates anteriorly upon the pelvic floor. Where the occiput turns behind it rarely rotates during labor to the front. The duration of labor is increased and the membranes often rupture prematurely. The mortality rate of the mothers in cases most favorable for the mechanism of labor was $6\frac{2}{10}$ per cent., while in unfavorable cases the mortality rate was 17 per cent. Of the children 40 per cent. perished.

So far as treatment is concerned, it is of first importance that the size and contour of the pelvis be accurately ascertained. An effort should also be made to estimate the size and possibilities of moulding of the fœtal head. Where cases are seen during pregnancy labor should be induced if the distance between the tuberosities of the ischia measures from $8\frac{1}{4}$ cms. to $6\frac{1}{2}$ cms. Labor should not be induced before the thirty-fourth week. If the patient comes to the physician at the end of pregnancy symphysiotomy may be done if the distance between the tuberosities of the ischia measures $5\frac{75}{100}$ cms. In private cases, if a greater measurement is found, the cautious use of the forceps is indicated. Cæsarean section is indicated in those cases where the distance between the tuberosities of the ischia is less than $5\frac{5}{10}$ cms. The author recommends podalic version in nearly all cases. Where the child is dead and the pelvis is small, craniotomy can be performed.

Klien adds an interesting postscript describing his experiment of perform-

ing post-mortem symphysiotomy upon the body of a patient who had died during pregnancy. The diameters of the pelvis were found to have been increased from 3 to 4 cms.

Two Cases of Unusual Laceration of the Perineum.

Flesch (*Centralblatt für Gynäkologie*, 1895, No. 45) reports the case of a young woman, aged nineteen years, who sustained at labor an injury to the perineum which consisted of a central laceration which left the posterior wall of the vagina at its lower portion intact, but tore the tissues between the bowel and the vagina, the head being born apparently through the anus. The patient was delivered under the care of a midwife. The sphincter of the bowel was entirely torn apart. The laceration was repaired, the patient making a good recovery.

His second case was one in which a resisting hymen did not permit the expulsion of the head. The hymen was torn in an annular manner, being entirely separated from the surrounding tissue. It was necessary to remove the hymen, and close raw surfaces with catgut stitches.

Three Symphysiotomies in the Obstetric Wards of the Hospital of Riga, Russia.

In the *St. Petersburger Medicinische Wochenschrift*, 1895, No. 43, Treymann reports, among other operations, three symphysiotomies. The patients were between twenty-eight and thirty years of age, and all multiparæ. They had all borne children with very difficult labors. Two of the patients were infected with the germs of erysipelas before the operation. The children were all at full term, one of them weighing nine pounds. One of the children died following a difficult forceps extraction. The mothers recovered, although one of them had fever for some time. The second of these patients, aged thirty years, died sixteen months after the operation, from dysentery. An opportunity was obtained to examine the symphysis, when it was found that perfect union had taken place.

A Successful Symphysiotomy.

In the *American Gynecological and Obstetrical Journal*, 1895, vol. vii. No. 5, Jewett reports the case of a multipara whose pelvis was deformed by the jutting forward of the promontory of the sacrum. The fœtus had failed to descend after prolonged and severe labor. Symphysiotomy was readily performed, the joints being opened with a bistoury. A profuse venous hemorrhage was controlled by pressure and gauze-packing. A fistula occurred through the centre of the joint, which finally closed. The child did well for a week or more, but finally died of pemphigus. The case is of interest as being a typical one for symphysiotomy. The slight pelvic contraction and the dilated birth-canal gave the best conditions possible for the operation. The patient's exhausted state and the probability of previous infection were the unfavorable elements in the case.

Unoxidized Products of Digestion as Cause of Eclampsia.

Among the many recent interesting contributions to the literature of this subject is that of Massin, of St. Petersburg, in the *Centralblatt für Gynäkologie*, 1895, No. 42. From experimental studies he is convinced that in the body of the pregnant patient, and especially at the end of pregnancy, there exists an abundance of but partially oxidized products, which he terms "leukomaines." These are ordinarily broken up and excreted by the liver and kidneys, but in cases where these organs are at fault these products may remain within the body of the patient. Their immediate absorption and the effect which they produce depend considerably upon the condition of the nervous system. Whatever increases the sensitiveness and irritability of the nervous system favors the absorption of this material, which is capable of producing eclamptic convulsions when in considerable amount.

The Histological Study of the Changes in the Uterus During the Existence of Tubal Gestation.

Pilliet describes in the *Annales de Gynécologie*, October, 1895 researches which he has made in studying the changes which the uterus undergoes during tubal gestation. He finds that a true deciduous membrane forms within the womb in these cases. It is usually expelled at from six weeks to three months of pregnancy. Two conditions in these cases attract attention: the first is the characteristics of the deciduous membrane as found in the uterus, and the second the condition of the uterus after the expulsion of the decidua. So far as the first is concerned, the decidua found within the womb in cases of ectopic gestation is remarkably swollen and engorged. It resembles normal mucous membrane but little. Upon the superficial aspect of the membrane there are abundant bloodvessels which are in a condition of engorgement, while the tissues surrounding them are somewhat œdematous. In some places exudations of blood and serum may be observed. Some of these hemorrhages are the result undoubtedly of exertion and fatigue, and resemble the premature detachment of the placenta. In other places the extravasated blood is found to contain placental villi. This decidua may be expelled in considerable quantities, or it may be gradually extruded with its cellular elements in an abundant sero-sanguinolent fluid. In the latter case its recognition is more difficult. This tissue resembles very closely the network of capillaries found in granulations and in sarcomatous tissue. The muscular tissue which underlies the basement membrane was also hypertrophied, undergoes involution slowly, but shows no signs of genuine inflammation.

After the expulsion of the decidua the uterus presents many signs of parenchymatous metritis in the vascular lesions present in the dissection of muscular fibre by layers of embryonal cells. This condition may be traced to the peritoneum. When curetting is practised in these cases but little is removed, because the decidua has all escaped. New tissue gradually develops where the decidua has been removed, and the epithelium is slowly reformed. The condition of metritis may persist for a long time; without the clinical history of the case microscopic examination would render it

difficult to make a diagnosis. From these studies it is easy to observe how readily the one condition present may be overlooked, if the physician confines his attention to the condition of the uterus. Without a thorough examination of the pelvis, and without studying the clinical history of the case, the true diagnosis may readily be missed.

Pelvic Contraction.

In the *Medical Record*, 1895, vol. xlviii. No. 17, Austin Flint, Jr, summarizes the records of 6000 cases of pregnancy in which contraction of the pelvis was noted in 654, $10\frac{9}{10}$ per cent. Comparison of the measurements of the head, weight, and length of the child, with the measurements of the pelvis, gave no definite results. In $86\frac{8}{100}$ per cent. (563 of the 654) delivery was spontaneous. In all of these cases the contraction was slight, the true conjugate being three and one-half to three and one-third inches. In 91 cases operative interference was necessary, and 101 operations were performed. The general results in the 654 cases of contraction of the pelvis were one maternal death from placenta praevia and shock. Of 663 children, 31 were stillborn, a total infant mortality of $5\frac{58}{100}$ per cent.

It is important to notice from these facts, that contraction of the pelvis is nearly as frequent in America as hospital reports state it to be in Germany. As regards treatment, where there is but a slight contraction, a true conjugate of three and one-half inches or more, the treatment should be expectant. The bladder and rectum should be kept empty and the patient stimulated and supported. Where the internal conjugate is less than three and one-half inches, operative interference is usually demanded. If the true conjugate be but little less than three and one-half inches, forceps or version may be selected. In the use of forceps, a little more than 25 per cent. of infant mortality resulted. In version, a little more than 13 per cent. When greater contraction is present a radical operation is demanded.

GYNECOLOGY.

UNDER THE CHARGE OF

HENRY C. COE, M.D., M.R.C.S.,

OF NEW YORK.

Conservative Operations on the Ovaries.

Delange (*Arch. de Toc. et de Gyn.*, 1894, No. 3) reports the results of his conservative operations on the ovaries, pregnancy subsequently occurring in 30 per cent. of the cases. At the same time he does not believe that the possibility of the patient's afterward conceiving is the main object aimed at.

Donnef (*Centralblatt für Gynäkologie*, 1895, No. 33) thinks that resection or ignipuncture is indicated in the case of every young woman who presents evidences of chronic oöphoritis associated with a healthy condition of the

uterus and tubes. When the uterus is diseased, or the patient is near the climacteric, hysterectomy is preferable.

MATHAEI (*Zeitschrift für Geb. u. Gyn.*, Bd. xxxi., Heft 2) reports six cases of ovariotomy in which partial disease of the opposite ovary was found. As the patients were young women, only the macroscopically diseased portions of the ovaries were excised, the raw surfaces being united by sutures in the usual manner. Five out of the six patients subsequently conceived and bore living children. The writer recommends this procedure in all cases of ovariotomy in which the opposite ovary contains retention-cysts too large or too numerous to be treated by ignipuncture, or even when a small dermoid cyst is present not involving the entire ovary. Exceptionally, healthy stroma may be preserved in the case of a small proliferating glandular cystoma. If the patient has passed the climacteric, or there is a suspicion of malignancy, the ovary should be entirely removed.

INTRACTABLE UTERINE HEMORRHAGE.

SIVITALSKI (*Centralblatt für Gynäkologie*, 1895, No. 33) reports the case of a woman, aged twenty-nine years, who began to have profuse metrorrhagia a week after the cessation of the menstrual flow. The same phenomenon was noted after the following period, when the patient became so exsanguinated that she entered the hospital. The removal of a quantity of hypertrophied mucous membrane by curettage failed to check the bleeding, which recurred a few weeks later and could not be controlled. She was re-admitted to the hospital, and a digital examination of the uterine cavity was made with a negative result. It was finally decided to perform hysterectomy, for the patient was *in extremis*. A careful examination of the specimen threw absolutely no light upon the cause of the hemorrhage, as the only pathological change noted was a minor degree of interstitial endometritis. The adnexa were normal. The patient developed a pelvic abscess, but eventually made a good recovery.

The writer calls attention to the rare occurrence of metrorrhagia without any discoverable local or general cause, and regards it as a clear indication for total extirpation.

HYDRASTININ IN UTERINE HEMORRHAGE.

KALLMARGEN (*Zeitschrift für Geb. u. Gyn.*, Bd. xxix.) reports the ultimate results of treatment with this drug in eighty-six cases of uterine hemorrhage, his observations extending over two and one-half years. The best results were obtained in simple menorrhagia, post-partum hemorrhage, and in bleeding due to hæmatocele and disease of the adnexa. In chronic endometritis it seemed to have little effect, and it is contraindicated in pregnancy and in cases of uterine fibro-myoma and inoperable carcinoma.

TOTAL EXTIRPATION OF THE UTERUS, WITH SUTURE OF THE PERITONEUM.

BÜCHELER (*Zeitschrift für Geb. u. Gyn.*, Bd. xxx., Heft 2) presents the statistics of Kaltenbach's operations performed according to his method, in

which the peritoneal flaps are sutured. Out of 159 vaginal hysterectomies, 153 were performed for malignant disease, with a mortality of 3.8 per cent.; 92 patients were kept under observation from three to seven and one-half years. There were seven cases each of vesical and ureteral fistula and one of fecal fistula; the ureter was ligated once. The writer compares the mortality with the combined mortality of other German operators (9.5 per cent.), and also with the statistics of clamp-operations, and attributes the superior results to the use of the peritoneal suture, as well as to the rigid asepsis which is maintained during and after operation.

Chlorosis an Infectious Disease.

Clement (*Lyon Méd.; Centralblatt für Gynäkologie*, 1895, No. 40) affirms his belief in the infectious origin of chlorosis, founding his opinion on the similarity between this and other infectious diseases. He observed an epidemic form in a small village, in which eight young girls under favorable hygienic conditions were successively affected, fever being the initial symptom. Enlargement of the spleen was constant, phlegmasia alba, dry pericarditis, and pleurisy being frequent complications. These could hardly be explained by a simple disturbance of the hæmatopœtic function.

Retro-rectal Dermoids.

Schulze (*Deutsche med. Wochenschrift*, 1895, No. 22) describes an operation for the removal of two dermoid cysts situated behind the rectum, extending from a point just above the sphincter ani as high as the pelvic diaphragm. The writer believes that these tumors originate not from the ovary, but from the spinal canal or external skin, and advises their removal through an incision in the perineum, the ischio-rectal fossa being opened by a cut extending from the posterior third of the right labium majus to a point an inch above the anus; the levator ani is separated in the direction of its fibres.

Infection of Ovarian Cysts.

Mangold (Inaugural Dis.; abstract in *Centralblatt für Gynäklogie*, 1895, No. 40) distinguishes two forms of infection—saprophytic and septic. The former causes suppuration of the cyst-contents, and is recognized by the hectic character of the fever, slight pain and general disturbance, the absence of evidences of peritonitis, and the presence of gas in the upper portion of the cyst. The prognosis is good. Great care should be exercised to remove the cyst intact, or, in the event of rupture, to protect the peritoneal cavity and wound. Septic infection is due to the presence in the cyst-contents of pyogenic cocci, gonococci, and the bacilli of typhoid, tuberculosis, and the colon bacilli. Chills, fever, rapid pulse, peritonitis, and profound general disturbance indicate the serious nature of the process. The prognosis is less favorable than in the former case. Bacteria may enter a cyst by direct implantation, through the venous circulation (especially from a septic puerperal uterus), through the lymphatics, by extension from an infectious peritonitis, and from the gut when the latter is adherent to the cyst. Puncture, inci-

sion and drainage, coitus during menstruation, the puerperium, infectious diseases (typhoid and malaria), gonorrhœa, salpingitis, and peritoneal tuberculosis are all etiological factors. The spontaneous suppuration of dermoids is due to the setting free of a pyogenic irritating substance from the cyst-contents.

Irritable Bladder in Women.

Dacheux (*Thèse de Paris;* abstract in *Centralblatt für Gynäklogie*, 1895, No. 40) affirms that the condition which has previously been regarded as a purely functional derangement is really, as Zuckerkandl states, due to a localized hyperæmia of the mucosa, which can be demonstrated by the endoscope. Hyperæmic patches are seen at the *bas fond*, less often at the beginning of the urethra, which bear a close relation to concomitant congestion of the uterus and adnexa, and often disappear when the latter is relieved. In obstinate cases cystotomy is advised.

Hemorrhage after Vaginal Hysterectomy.

Pichevin (*Gaz. méd. de Paris*, 1895, No. 11) calls attention to the danger of hemorrhage in clamp-operations. The clamp may cut through the included tissues, or the latter may slip from their grasp. This slipping is especially apt to occur when the upper portion of the broad ligament is twisted, as it must be, when it is clamped from above downward and the stump is subsequently drawn into the vagina. Cases of hemorrhage on removal of the clamps, forty-eight hours after operation, have been reported, some of which have terminated fatally. Some surgeons have been able to check the bleeding with tampons, but others have been obliged to resort to cœliotomy. The writer recommends compression of the aorta. He would use clamps only in cases of hysterectomy for pelvic suppuration, in which it is impossible to draw down the uterus.

[The inference from the writer's unfortunate experience with clamps is that he must have used imperfect instruments.—H. C. C.]

Abdominal Hysterectomy for Fibroids.

A. Martin (*Berliner klin. Wochenschrift*, 1895, No. 29) reviews the history of total abdominal extirpation of the fibroid uterus, giving due credit to the pioneer work of American surgeons, and describes his own *technique*, which is briefly as follows: The vagina is thoroughly cleansed twenty-four hours before operation, and is tamponed with sublimated gauze. Immediately beforehand it is scrubbed with soap and water, alcohol, and sublimate solution. The Trendelenburg posture is not used, although the writer has no decided objection to it. After opening the abdomen the growth is lifted out *in toto*, traction being assisted by pressure exerted *per vaginam* if necesary. In some cases it may only be possible after removing some of the smaller tumors. The broad ligaments are ligated in the usual manner with juniper-catgut; one side being completely secured before the opposite ligament is ligated. A Richelôt's clamp is applied to the stumps outside of the ligatures. The uterus is then detached as low as the vaginal attachment, and the vagina

is opened posteriorly, preferably by boring into it with the end of a dressing-forceps; the edges of the vaginal wall and the peritoneum of Douglas's Pouch are then united by interrupted sutures. The bases of the broad ligaments are sutured to the lateral walls of the vagina in the same manner, the cervix meanwhile being drawn upward with a volsella. Finally, the bladder is dissected off from below, the sutures, which have been previously passed through the anterior wall of the vagina and vesico-uterine fold, are tied, and the uterus is removed. The ligatures, which are left long, are drawn down into the vagina and the peritoneal flaps are united. Drainage is not employed. The abdominal wound is then closed. The operation is often completed by the writer in thirty minutes or less, and the patients' convalescence is uneventful, so that they are usually discharged at the end of two weeks.

In 204 cases of hysterectomy the ureter was tied twice with a fatal result, but the bladder was injured in only two instances, due, the writer thinks, to the fact that he separates it from below upward before opening the anterior vaginal fornix, the procedure being materially assisted by maintaining upward traction on the uterus. Hemorrhage is entirely avoided by ligating all the vessels before they are divided.

In 43 cases, up to 1893, in which the peritoneum was not closed, the mortality was 30.3 per cent.; in 54, in which it was closed, 9.5 per cent. In 81 cases since that time, in which the above-described *technique* was adopted, the mortality was 7.4 per cent.

Effect of Influenza on the Female Sexual Organs.

Müller (*Münchener med. Wochenschrift*, 1895, No. 41) noted the condition of the pelvic organs in 157 cases of influenza, 21 women being pregnant. Of the latter 17 aborted. Of the non-gravid women all but three showed symptoms of uterine disturbance, either hemorrhage or aggravation of previous troubles. Hemorrhagic endometritis commonly developed, as in cholera, typhus, and other infectious diseases. After the decline of the disease the uterus was frequently found to be enlarged and evidences of chronic endometritis were present, which seemed to be directly due to the influenza.

Early Recognition of Cancer of the Uterus.

Kessler (*St. Petersburger med. Wochenschrift*, 1895, No. 37) calls attention to the fact that while cancer of the uterus if attacked in the early stage can be cured by a radical operation, the mortality of which is only 5 per cent., as a matter of fact, not over 15 per cent. of those thus treated survive, because the patients apply too late to be cured. Statistics show that in the majority of the cases well-marked symptoms have been present for a year or more before the disease was recognized, and that in 50 per cent. of these the family physician failed to make a vaginal examination, which should never be omitted in the case of any woman forty-five years of age, or upward, with atypical hemorrhages. The importance of recognizing cancer in the incipient stage cannot be too strongly impressed upon the laity.

PÆDIATRICS.

UNDER THE CHARGE OF

LOUIS STARR, M.D.,
OF PHILADELPHIA;

ASSISTED BY

THOMPSON S. WESTCOTT, M.D.,
OF PHILADELPHIA.

THE OCCURRENCE OF SECONDARY RASHES IN SCARLET FEVER.

A. GRIFFITH (*Quarterly Medical Journal*, October, 1895, p. 23) considers this subject in a brief paper based on his experience in the Bagthorpe Fever Hospital, Nottingham. After referring to the proneness of scarlatina patients during convalescence to exhibit a scarlatiniform rash at the onset of an acute tonsillitis, rhinitis, or nephritis, the author considers the cases in which the rash is attended by all the symptoms of scarlet fever, with no other possible explanation for its occurrence. According to the author's experience all patients who have presented a scarlatiniform rash some days or weeks after admission to the wards may be arranged in three groups: 1. Those whose illness presented all the signs of moderate or severe scarlet fever, with a high temperature (103° or more), keeping up at nearly the same height for at least three evenings; and in whom there was no good evidence of a previous attack of that disease. 2. Those in whom the illness resembled scarlet fever in nature, the rash lasting from twenty-four hours to four days, with sore throat and general constitutional disturbance, the rise of temperature being not so great as in Group 1, but either high at the commencement, with a steady gradual fall, or remaining at a lower level (100° or 101°) during the continuance of the rash, and falling as the latter faded, and in whom there was clear evidence of genuineness of the first attack of scarlet fever. 3. Includes many different conditions in which a rash was observed for twelve to twenty-four hours, but is to be omitted as doubtful. Those of the first group are considered as primary attacks, while the second are here discussed as relapses. Out of about 2000 cases admitted for scarlet fever there were 14 that suffered from what was considered as second attacks of the fever. If the author's view is to be accepted, and these later rashes are to be explained as indicated (agreeing with the experience of other large isolation hospitals), the question arises whether the illness is due to auto-infection, being properly termed a "relapse" or "recrudescence," or whether it depends on the presence of other patients in the same ward, some of whom may have fever of a more virulent character. It is not difficult to imagine that in a ward containing 12 to 20 patients, even with 2000 cubic feet of air-space each, the amount of infection is very large, the virulence being possibly increased by aggregation as well as by the uniform temperature of 60° F., nor to suppose that those who have had mild attacks from a small dose of poison in the first place,

rather than from their insusceptibility, may be insufficiently protected against a larger dose of a more virulent infection. If this is the correct explanation, it would point to the inadvisability of aggregating fever cases in large wards, and still more to the fault of the usual plan of placing mild and medium, if not severe, cases in the same wards and in the hands of the same nurses.

Intra-uterine Infection with Typhoid Fever.

Freund and Levy (*Berliner klinische Wochenschrift*, 1895, No. 25, p. 539) record the case of a woman in the fifth month of her third pregnancy, who fell ill of typhoid fever. In the fourth week of her illness she aborted. The birth was conducted under strict antiseptic precautions with the intention of submitting the fœtus to a thorough bacteriological examination; this was begun twenty minutes after birth, the fœtus having died fifteen minutes after the cord was cut. Cultures were taken from the placenta, the pulp of the spleen, and the blood from the heart, and in all three the bacillus of Eberth was found. The differential diagnosis as regards the colon bacillus was made by the morphological and biological characteristics of the cultures and by inoculation tests. Cultures from the superficial parts of the placenta and from the vernix caseosa remained sterile, thus excluding the possibility of accidental infection. The anatomical lesions of the fœtus were confined to a slight hypertrophy of the spleen, which appeared a little softer than in the normal state. The patches of Peyer were not ulcerated and the intestinal mucous membrane was normal. The absence of specific lesions, which is common to all cases of intra-uterine infections, is attributed by the author to two facts: to the septicæmic form which all such intra-uterine infections exhibit, and to the absence of functional work in the special organ which in the adult the micro-organism chiefly attacks.

Icterus Neonatorum.

Schreiber (*Berliner klinische Wochenschrift*, 1895, No. 25, p. 543) believes that of all the theories advanced to explain this phenomenon, that of Quincke is the only one that sufficiently explains all the facts. This theory attributes icterus of the newborn principally to the persistence of the venous canal of Arantius; by this avenue the biliary pigment absorbed from the intestine would pass directly into the general circulation and would not be retained, as in the adult, in the liver. Beside this principal factor Quincke cited several subordinate ones, namely, the abundant production of bile through the destruction of red blood-cells, the inadequateness of urinary excretion in the newborn, the richness of the meconium in biliary pigment, and the non-transformation, in the intestine, of bilirubin and urobilin, due to the absence of intestinal putrefaction in the newborn.

These propositions Schreiber verifies from his own observation. Quincke cited 5 cases of persistence of the canal; the author has observed it in 7 cases, and calls attention to the results of Elsässer, who, in 200 infants dying within the first eight days, found the canal closed in but 23, and in only 3 out of 78 which had perished very shortly after birth. Injection experiments demonstrated that the blood passes through the canal; and by other experi-

ments he was able to show that blood from the intestine passes by the hemorrhoidal veins into the vena cava without passing through the liver.

Concerning the absorption of bile pigment from the meconium, the author has shown by experiments upon dogs that, when bile was injected into the rectum, in all cases the bile-pigment appeared in the urine and the hemorrhoidal veins showed evidence of staining.

The conditions of urinary excretion are also important, for it is evident that when little urine is passed in the early days of life the system is imperfectly relieved of the bile pigments.

A Case of Trismus and Tetanus Neonatorum.

Baginsky (*Berliner klinische Wochenschrift*, 1895, No. 7) records a case under this title in a strong, well-nourished female infant nine days old, who had been ill for twenty-four hours. The case was submitted to antitoxin treatment according to the method of Behring and Kitasato, six injections being given over a period of four days. Death occurred upon the fifth day of the disease. Cultures of serum from the navel made on the second day of the disease showed the tetanus bacillus, and produced in a mouse typical tetanus and rapid death.

A Case of Blenorrhagic Arthritis in a Newborn Infant.

Haushalter (*Congrès de Médecine interne de Bordeaux, Revue mens. des Mal. de l'Enfance*, October, 1895) adds a new case to the few already reported in which arthritis was associated with a purulent ophthalmia in a newborn child. The right knee and left wrist were the joints involved; the knee was more severely affected and was the seat of an abundant affection which contained polynuclear leucocytes, and showed the presence of the gonococcus.

According to the author this is the eleventh case of the kind reported. [Vignaudon (*Revue mens. des Mal. de l'Enfance*, May, 1895), in a paper written before January, 1894, gives the notes of twelve cases following ophthalmia collected from the literature, and eleven cases following vulvo-vaginitis, including two observations of his own.] A study of the cases shows that there is no connection between the development of the arthropathy and the abundance of the ocular suppuration. In the great majority of cases gonorrhœal rheumatism in the newborn is mono-articular or oligo-articular; the knee is almost constantly involved, much more frequently than with older children or with the adult. The general condition is little affected and fever is habitually absent. The duration is scarcely more than a month, and cure results without deformity.

The Appearance of Bacteria in the Intestine of the Newborn before Feeding is Begun.

Schild (*Zeitschrift f. Hygiene und Infectionskrank.*, 1895, Bd. xix. S. 113) presents an interesting study of the bacteriology of the meconium of fifty newborn infants. Specimens were taken aseptically from the rectum at various intervals after birth, but before any form of nourishment was administered.

Under these conditions it was found that the meconium, sterile at birth, became infected at the end of four hours in the earliest instances, and not later than twenty hours in any of the cases, the average time being between the tenth and seventeenth hours of life. The following microbes were encountered: the porcelan-coccus of Escherich, the liquefying fluorescent bacillus, the non-liquefying fluorescent bacillus, the bacillus subtilis, the colon bacillus, the proteus, and a bacillus which the author was unable to classify. It is interesting to note that the bacillus coli communis was found very infrequently, and the bacterium lactis aërogenes was never found, thus confirming Escherich's earlier studies of the meconium.

Under the conditions of the observations the mode of infection was directly by way of the anus and rectum. The author shows that micro-organisms accidentally introduced into the mouth and swallowed with the saliva take more than twenty-four hours to reach the meconium, and then require several hours to multiply in this culture medium. On the other hand, the microbic flora of the peri-anal region appeared several hours before the infection of the meconium and embraced the varieties later observed in the rectum. This observation is conclusively proven by the fact that in three cases after disinfection and antiseptic dressing of the peri-anal region the meconium remained sterile for twenty hours. As sources of this infection the author mentions the water of the bath, in which, beside innumerable other microbes, the seven varieties above named were found; the air of the lying-in chamber, in which four of the seven varieties were recognized. The linen and vaginal secretions of the mother do not seem to play any part in this connection except in very rare instances.

Dysenteric Lesions following Measles.

Meslay and Jolly (*Revue mensuelle des Maladies de l'Enfance*, August, 1895, p. 370) report the cases of four children suffering from measles admitted within a short period to the Hôpital Trousseau; the disease in each case was complicated with a diarrhœa characterized by mucous and bloody stools; all four children died with broncho-pneumonia. At the autopsy, apart from the pulmonary lesions which seemed to have been the immediate cause of death, there was found ulceration of the sigmoid flexure and rectum absolutely analogous to those of a true dysentery, but with small follicular ulcers extending even to the small intestine, and in the most aggravated case far up in the small gut. Rilliet and Barthez have described a form of dysenteric diarrhœa as occurring under their observation twice after measles and four times after variola, but in none of these cases did the ulceration of the intestinal mucosa compare with that in one of the cases here recorded, which is approached only by a case of ulcerous colitis reported by Worthington (*British Medical Journal*, November 30, 1889).

It may be added that such an intestinal complication adds greatly to the gravity of the prognosis of a broncho-pneumonia occurring under these conditions.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

EDWARD F. WILLOUGHBY, M.D.,
OF LONDON;
AND
CHARLES HARRINGTON, M.D.,
INSTRUCTOR IN MATERIA MEDICA AND HYGIENE, HARVARD MEDICAL SCHOOL.

Cholera Bacilli and Uncooked Milk.

Dr. Fritz Basenau's experiments (*Archiv der Hygiene*, xxiii. p. 170) on the life of cholera bacilli in milk appear to disprove the conclusions of Hesse, who found that uncooked milk has the property of killing the cholera germ within twelve hours. Basenau finds that not only it does not possess this power, but that the germs are active after thirty-eight hours, and that up to the point of coagulation they considerably increase in number. In polluted milk they were found to be active for at least thirty-two hours at different temperatures (24°, 37°, and at the room temperature), and to remain so even after the milk is coagulated. With these results in mind, the recommendation of Hesse to use milk as a prophylactic and curative agent in time of cholera must not be too readily accepted.

Poisonous Action of the Aqueous Vapor of Expired Air.

Dr. Livierato (*Arch. Ital. di Biol.*, 1895, p. 279) condensed the aqueous vapor of the breath of persons afflicted with disease of the respiratory tract accompanied by fever, of the same without fever, of persons with fever but with no respiratory disease, and of persons in health, and injected the liquids obtained into rabbits. That from the first mentioned caused a fever lasting from three to six days, dulness, and diminished reflexes; that from the patients with no fever gave the same results, but less marked; that from persons with fever but no respiratory disease produced little or no effect, and that from persons in health none whatever. The results were the same in each case when the liquid used was sterilized.

Typhoid Fever, Polluted Water, and Flies.

Surgeon-Major Battersby, A.M., S. Chitral Relief Force (*British Medical Journal*, August 10, 1895) suggests the probability of the existence of some other cause for typhoid fever than impure drinking water, inasmuch as "here in India we witness year by year outbreaks of enteric which are most difficult, if not impossible, to trace to a water-borne cause." He then draws attention to the part taken by the common house-fly as a carrier and disseminator of the disease, and speaks of the universal prevalence of enteric fever among Europeans in India; and *apropos* of water as a cause says: "Our water supply has in many instances been above suspicion, being procured from springs coming directly from the mountain-side, and yielding no reaction as to oxi-

dizable organic matter when tested with permanganate of potash solution." The theory of Dr. Battersby as to the part taken by the house-fly as a disseminator of the disease is opposed by Dr. Gilbert Kirker, Staff Surgeon R. N. (*British Medical Journal*, August 24, 1895), who writes: "The contrast between the statement of theory and the statement of the actual occurrence is very striking, and I take advaniage of it to direct attention to a different aspect of the causation of the enteric and other fevers from which British sailors and soldiers suffer in hot climates. Surgeon-Major Battersby, finding that the theory of water causation did not fit the facts, has recourse to flies as the carriers of the poison and disseminators of the disease. To my mind, however, the fly-borne, as well as the water-borne, theory leaves unexplained the constantly observed but much neglected fact that while strangers are suffering the natives are in good health. The native Egyptian, whom I know, abhorring filters, drinks the highly contaminated Nile water and lives in a swarm of flies, yet he is also not attacked by typhoid fever, while the carefully fostered British soldier is." Dr. Kirlen attributes the trouble to the "ignorance of the art of living in hot climates."

These two communications bring most forcibly to mind the experiments and conclusions of Flügge, Arnould, Kraus, Karlinski, and others, that the typhoid bacillus and certain other pathogenic micro-organisms have a better chance of life in sterilized or organically pure water than in grossly polluted water, in which they appear to be soon overcome by the other non-pathogenic bacteria.

American versus German Beef.

Boysen and Vollers (*Mittheilungen für Thierärzte*, i, No. 8) record themselves against the widespread suspicion and dread of American beef imported into Germany as being tuberculous. Examination at Hamburg of over 8000 imported American beeves showed that only four, or 0.05 per centum, were tuberculous, while of native beeves for slaughter at the same place 8 per centum were found to be afflicted.

Powdered Meat.

The *Pharmaceutische Centralhalle* (1894, xxxv. p. 453) furnishes a recipe for a condensed meat which might be very valuable for military or other expeditions. Lean meat is cut into small strips, dipped into hot fat for a few minutes, then drained, and slowly dried in the oven. The dried meat is finally ground in a coffee mill. It has a pleasant taste and smell, keeps well, is not bulky, is easily digested, and can be used in many different ways.

Undesirable Immigrants a Menace to the Future American Physique.

Dr. J. W. Achorn (*The Dietetic and Hygienic Gazette*, June, 1895, "A Suggestion for the Preservation of the American Physique") communicates some interesting facts as to the physical condition of some of the immigrants admitted to this country from abroad, practically without examination, facts which should claim serious consideration by our national lawmakers. Dr. Achorn says that a steamer on which he returned to this country from

Europe brought 600 Italians, Hungarians, Polish and Hungarian Jews, Russians, Bohemians, Arabs, and other steerage passengers, among whom were seven lame and eighteen deformed. He examined 153 of the total 600, and found four cases of advanced phthisis, six of inherited syphilis, two of fetid abscess, three of syphilis, one of delirium tremens, nine of rickets, "any number of skin diseases, parasitical and otherwise," two of favus of the scalp, and three of chronic ulcer of the leg. Only one of the 600, a man with cataract of the left eye due to syphilis, was refused admission to the country.

Bubo Plague in China.

The plague broke out in Macau, a Portuguese colony thirty miles from Hong Kong, in May, 1894, but only six cases occurred. In February, 1895, it broke out again and soon became epidemic. In the absence of official statistics there is no way to learn the probable mortality, but it is known that during the second week in May as many as seventy or eighty deaths occurred daily. On June 12th the death-rate was fifteen daily. Only 10,000 of the 80,000 inhabitants remained in the town. The chief sufferers were the Chinese, though the Portuguese suffered severely. In Hong Kong, where plague raged in 1894, only six or eight English were attacked, showing, as was then stated, that the European is practically immune. The Portuguese of Macau, however, are not European Portuguese, but are descended from the parent stock which came to Macau 350 years ago and freely intermarried with the Chinese. At Macau the disease was exactly like that of 1894 at Hong Kong; the mortality was as severe and the bacillus identical.

It is surmised that the infection came originally from Canton, about one hundred miles away. Plague travels slowly and remains a long time in any community attacked. It appeared at Macau seven months after the disappearance of the disease at Canton. Assuming that it had started from Canton during the height of the epidemic there, say in May, 1894, it took nine or ten months to travel one hundred miles. That it is a soil-bred and a soil-supported disease there seems to be little doubt, and the belief that animals, especially rats, are the carriers daily receives confirmation. [From an editorial in the *British Medical Journal* of July 20, 1895.]

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All communications should be addressed to

Dr. Edward P. Davis, 250 South 21st Street, Philadelphia, U. S. A.

Or

Dr Hector Mackenzie, 59 Welbeck St., Cavendish Sq., London, W., Eng.

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